STADIUM ROAD PEDESTRIAN CROSSING STUDY

Minnesota State University, Mankato

December 2022

ACKNOWLEDGEMENTS

The Study was made possible by funding from the Mankato/North Mankato Area Planning Organization (MAPO) in partnership with Blue Earth County, the City of Mankato, and Minnesota State University, Mankato. Special thanks to the following partners who provided their expertise, time, and feedback for this Study to ensure it encompassed the needs of students, staff, and faculty who will benefit from transportation improvements in the study area.

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CHAPTER 1: INTRODUCTION

The Mankato/North Mankato Area Planning Organization (MAPO), in partnership with Blue Earth County, the City of Mankato, and Minnesota State University, Mankato, completed a study of Stadium Road from Ellis Avenue to Warren Street to improve the operation of the corridor and the safety of people crossing the roadway while walking, rolling, and bicycling.

STUDY OVERVIEW

The Stadium Road Pedestrian Crossing Study (herein known as "the Study") sought to identify opportunities to improve crossings of Stadium Road (also designated as County State Aid Highway (CSAH) 60) between Ellis Avenue and Warren Street. The approximately one-quarter mile section of Stadium Road serves Minnesota State Mankato pedestrian, bicycle, transit, and vehicular movements, as well as operates as a key corridor for residents, workers, and visitors within the broader area. The study goal is to develop potential solutions to improve safety and travel conditions for all modes using the corridor which includes primarily students and staff traveling between the main parking lots serving campus (and athletic facilities) south of the corridor to the rest of campus north. The school serves more than 14,000 students and 1,600 staff on a given day.

PREVIOUS PLANNING EFFORTS

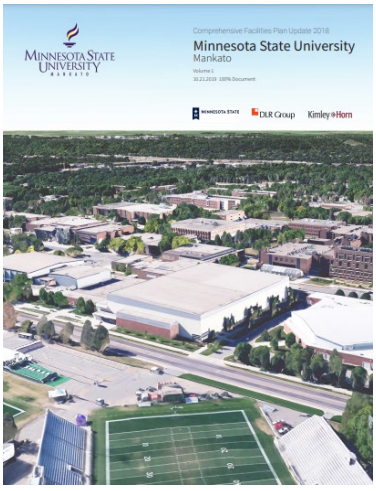
A review of previous plans was completed to identify supportive planning elements and synergies.

MAPO Long Range Transportation Plan (2020)

Identifies pedestrian crossing and safety improvements as illustrative projects at Ellis Avenue and Warren Street along Stadium Road (CSAH 60).

Minnesota State University Mankato Comprehensive Facilities Plan (2019)

The Warren Street intersection is identified as having transit delays due to heavy pedestrian traffic and modal conflicts between pedestrians and vehicles. Short-term crossing improvements are identified at Warren Street, the mid-block Rectangular Rapid Flashing Beacon (RRFB) crossing, and Ellis Avenue. In the mid-term, new gateway treatments are proposed at Warren Street to advertise entry into the campus area.



UNIVERSITY ENGAGEMENT

Meaningful engagement with students, staff, and faculty was emphasized throughout the planning process to ensure future improvements were transparently produced and supported by the campus community. A Project Management Team (PMT) comprised of members from the City of Mankato, Blue Earth County, Minnesota State Mankato, and the MAPO guided the Study. All engagement materials can be found in Appendix A.

Engagement activities included an online survey and two pop-up events held at the Centennial Student Union. Presentations were also held with the Mankato City Council, Blue Earth County Commissioners, Minnesota State Mankato Planning Committee, and both the MAPO Technical Advisory Committee and Policy Board. The Study was advertised through various mediums including a hosted study website by the MAPO, digital campus newsletter, and targeted emails to planning and engineering students.

Engagement during the second pop-up event in September 2022 at the Centennial Student Union. Source: SRF Consulting Group, 2022

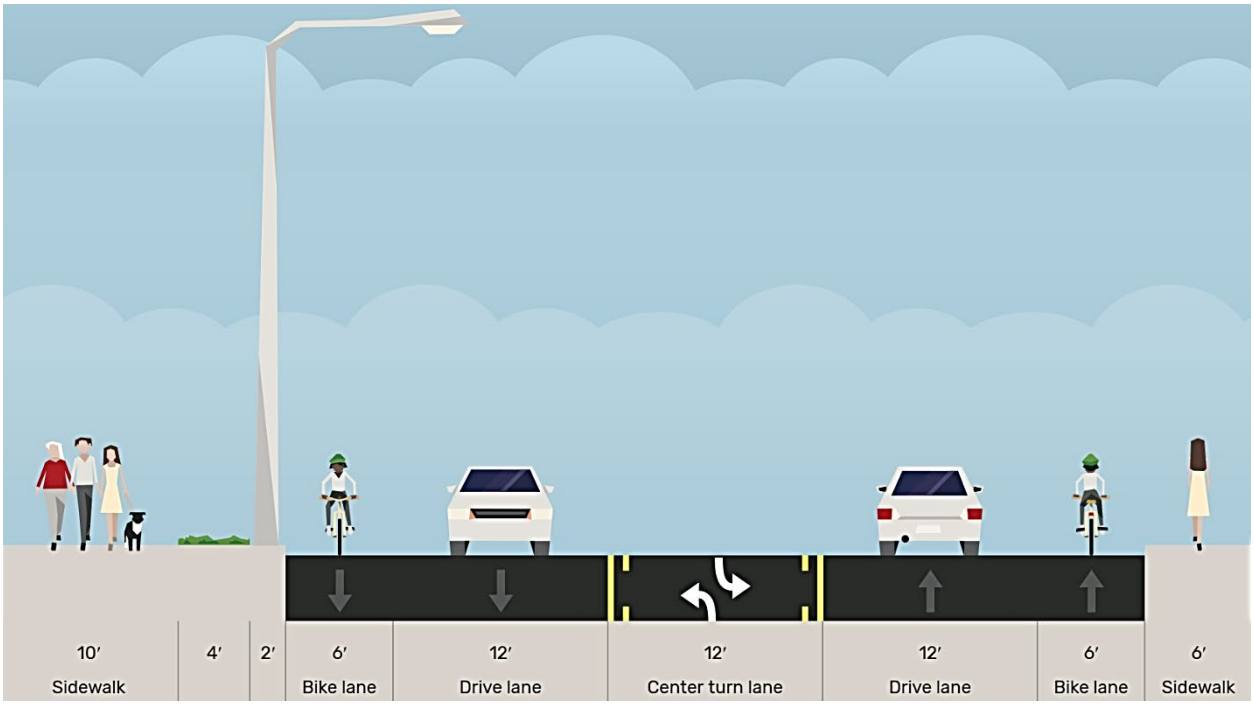
CHAPTER 2: CORRIDOR REVIEW AND ISSUE IDENTIFICATION

To develop meaningful transportation solutions, it is important to understand and quantify the existing characteristics of the study area. This process identifies transportation issues and opportunities necessary to provide safe and efficient operations for all users across Stadium Road (CSAH 60). The following section summarizes the existing conditions, outlines results from the first round of campus engagement, and issues identified from this analysis.

EXISTING ROADWAY

The existing typical roadway cross-section in the study area is a three-lane roadway with one travel lane in each direction, a center left-turn lane, and on-street bicycle lanes. The total right-of-way is about 70 feet of which Stadium Road (CSAH 60) is 48-feet-wide (see Figure 1).

Figure 1. Existing Cross-section

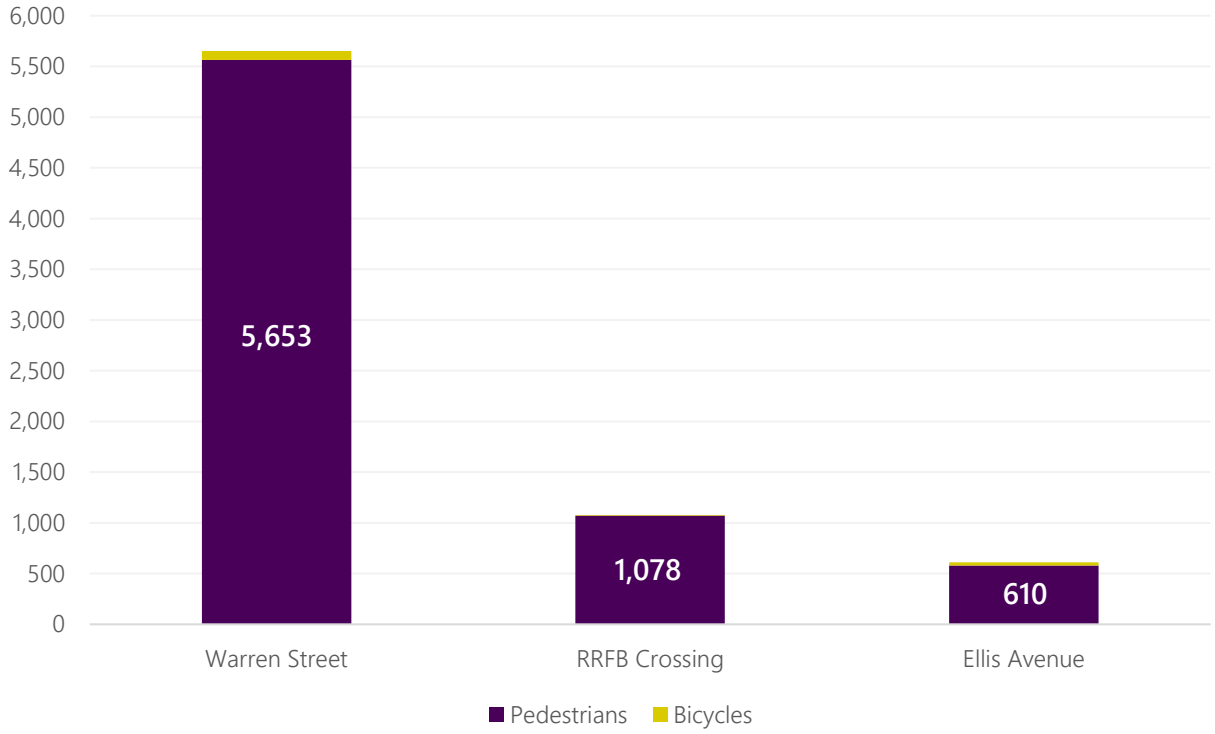


Source: SRF Consulting Group, 2022

WALKING, ROLLING, & BIKING

The corridor balances between auto and multimodal-focused uses with each allocated about 50 percent of the existing right-of-way. A sidewalk exists along both sides of the roadway with a boulevard along the north side and none along the south side in the study area. Six-foot-wide, on-street bicycle lanes exist as well, separating pedestrian and bicycle traffic. At the mid-block RRFB crossing a pedestrian island refuge (i.e., center median) exists with RRFBs for added traffic warning.

In April 2022, 13 hours of pedestrian and bicycle count data was recorded to understand existing demand. The number in white represents the total count per location during that period. Of note, nearly one-third of all trips through the Warren Street intersection during that time period were by walking or bicycling (5,653 pedestrians and bicyclists versus 10,912 vehicles).

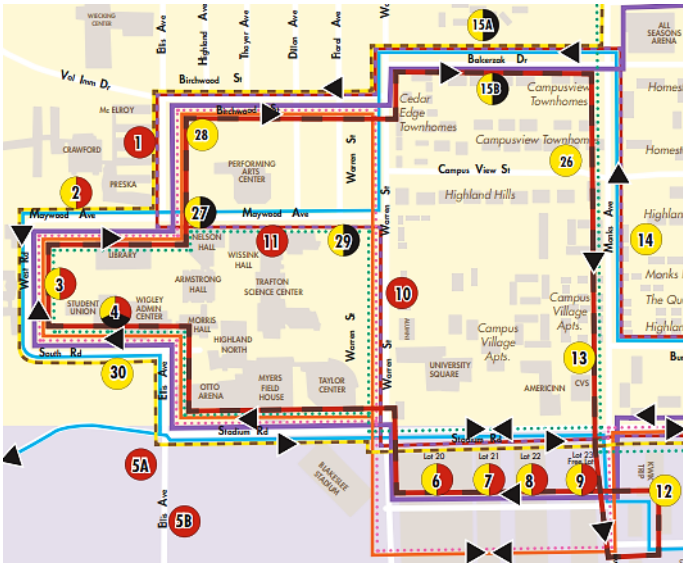


Source: SRF Consulting Group, 2022

Pedestrian delay was also studied to understand why users are participating in risk taking behavior. During peak periods delays can range from 30 to 50 seconds at the signalized intersections and less than five seconds at the RRFB crossing.

TRANSIT

Several transit routes operated by Mankato Transit Service and Minnesota State Mankato travel through the study area. These include the four versions of Route 1, Route 8 Campus Circulator, Route 9 Morning Express, Route 12 Nighttime Express, and the Campus Express. A bus stop exists on the north side of the corridor at the RRFB crossing (approximately 450 feet east of Ellis Avenue).



Existing transit routes. Source: Mankato Transit Service, 2021

VEHICLES

Stadium Road (CSAH 60) is functionally classified as a minor arterial roadway under the jurisdiction of Blue Earth County. Both Ellis Avenue and Warrant Street are streets under the City of Mankato's jurisdiction. Stadium Road (CSAH 60) operates as a key east-west connector for southern Mankato and main access roadway for the Minnesota State Mankato campus. Vehicle volumes and existing intersection traffic operations were reviewed to understand potential issue areas.

Traffic Volume and Speed

Vehicular activity was analyzed using annual average daily traffic (AADT) volumes along Stadium Road (CSAH 60) from MnDOT's publicly available data and turning movement count data collected in April 2022. As of 2017, the AADT was 10,600 of which over 300 were heavy vehicles. Historic volumes were reviewed from 2013 and showed a two percent decrease in traffic volumes during that time. The posted speed limit along Stadium Road (CSAH 60) is 30 miles per hour (mph).

Traffic Operations

Traffic operations were studied using existing turning movement counts. The threshold of acceptable traffic operations for Blue Earth County and the City of Mankato is a level of service D.

All intersections operate acceptably under existing conditions during the midday and evening peak hours (see Table 1). The morning peak hour was not studied as lower traffic volumes were recorded during that period compared to the other two times. The northbound approach at Warren Street does experience some delay, notably during the midday hour. Traffic modeling data (which used PTV VISSIM software) can be found in Appendix B.

Table 1. Existing Intersection Traffic Operations

Intersection	Traffic Control	Midday Existing	Evening Existing
Ellis Avenue	Signal	12 sec LOS B	13 sec LOS B
Warren Street	Signal	17 sec LOS B	14 sec LOS B

Signal = Traffic Signal Source: SRF Consulting Group, 2021

SAFETY

The analyzed crash data includes ten years of crashes specifically involving a pedestrian or bicyclist, as well as all crashes over the last five years. The manner of collision (e.g., rear end) was also studied over the last five years to determine contributing factors. The data was obtained from MnDOT's Minnesota Crash Mapping Analysis Tool (MnCMAT2) and includes recorded crashes by law enforcement with crash details and approximate location. Crash data points included those along Stadium Road (CSAH 60).

Pedestrian and Bicycle Crashes (2012-2021)

A total of four pedestrian crashes were recorded in the last ten years, all of which were at an intersection. Due to the smaller number of these types of crashes, ten years of data was studied to provide a larger sample size from which trends could be identified.

- Warren Street: 3 crashes resulting in possible injuries, all involving left-turning vehicles hitting a pedestrian at the crosswalk.
- RRFB Crossing: 1 crash resulting in serious injuries due to distracted travel and weather conditions.

All Crashes (2017-2021)

A total of 18 crashes were reported in the study area over the last five years which equates to a crash frequency of over three crashes annually along the 0.25-mile corridor.

- Warren Street: 9 crashes (1 minor injury, 2 possible injury, 6 property damage only) representing a variety of collision types (left-turn, angle, rear end, run off road, etc.).
- RRFB Crossing: 4 crashes (1 possible injury, 3 property damage only) of which half involved a rear end due to someone crossing with RRFB activation.
- Ellis Avenue: 5 crashes (3 possible injury, 2 property damage only) representing a variety of collision types (left-turn, angle, rear end, etc.).

UNIVERSITY ENGAGEMENT – ROUND 1

To introduce the Study and understand existing issues, needs, and opportunities, the University campus community was engaged with the first round taking place from April to May 2022 and involved several modes of online and in-person informational content and a pop-up event (see Appendix A).

Online Content

The Study leveraged the MAPO's website with a project webpage where project information, routine updates, and public engagement opportunities were shared. During Round 1, stakeholders were introduced to the study and encouraged to participate in a variety of ways, including signing up for project updates and taking an online survey.

Several comments were received through the online comment opportunity including:

- Perception that pedestrians and bicyclists do not press the button at the signal or RRFB to activate their crossing, and motorists do not stop, or yield right-of-way, for pedestrians or bicyclists. This unsafe behavior creates near daily close calls.
- The perception is most of the traffic traveling through Stadium Road (CSAH 60) here is university related traffic so appropriate pedestrian safety measures should be implemented.

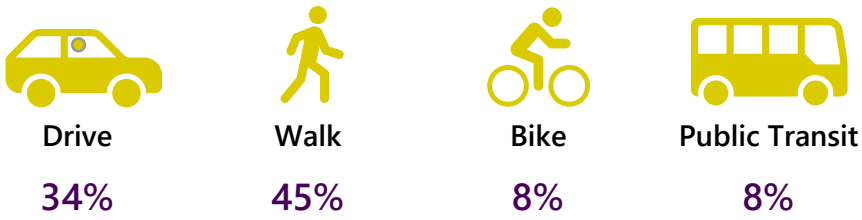
- Vehicles turning northbound left at Warren Street are very hindered by the number of pedestrian crossings. Grade separation here would be ideal.
- A diagonal crossing at Warren Street with phases only for pedestrians/bicyclists and then vehicles would be ideal. It could reduce backups for turning vehicles and the risk of pedestrians being hit by cars. It would also allow the buses to turn without having to wait for people crossing. This diagonal movement is most desired by students and staff.

Online Survey

The study team coordinated with Minnesota State Mankato to introduce the study and advertise the online survey via a campus newsletter and targeted emails to planning and engineering students. This online engagement yielded 44 unique users via an online survey. The survey provided a foundation to identify university priorities that guided the planning process, issues identification, and alternative development.

Approximately 48 percent of survey respondents travel along, or across Stadium Road (CSAH 60) daily and that increases to 93 percent for those traveling at least once per week. Most users of Stadium Road (CSAH 60) walk or drive in the study area (see Figure 2).

Figure 2. How do you use Stadium Road?[1]



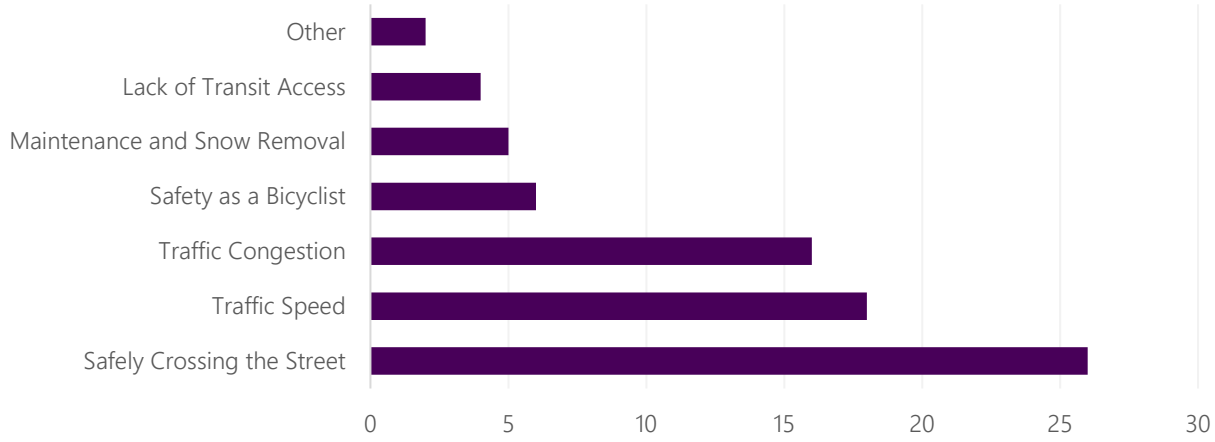
[1]*Three percent chose "other" and one percent use a mobility device. Source: SRF Consulting Group, 2021*

Respondents ranked each mode with their highest priority including:

1. Pedestrian (68%)
2. Car (15%)
3. Transit (10%)
4. Bike (7%)

The community's top three concerns include safely crossing the street, traffic speed, and congestion (see Figure 3). Notably, when asked about how safe they feel crossing Stadium Road (CSAH 60) while walking, rolling, or bicycling, 12 percent indicated that they have had a close call or have been hit by a motorist.

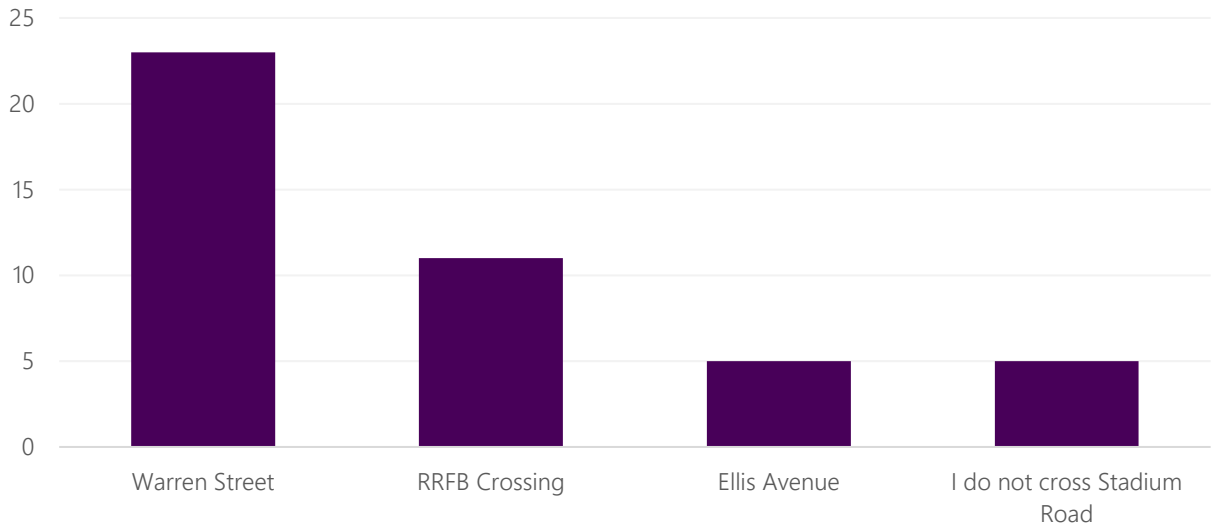
Figure 3. Please identify your top concerns about Stadium Road.



Number of respondents shown by crossing. Source: SRF Consulting Group, 2022

Over 50 percent of respondents most often cross at Warren Street (see Figure 4).

Figure 4. Within the study area, I most often cross Stadium Road as a pedestrian or bicyclist:



Number of respondents shown by crossing. Source: SRF Consulting Group, 2022

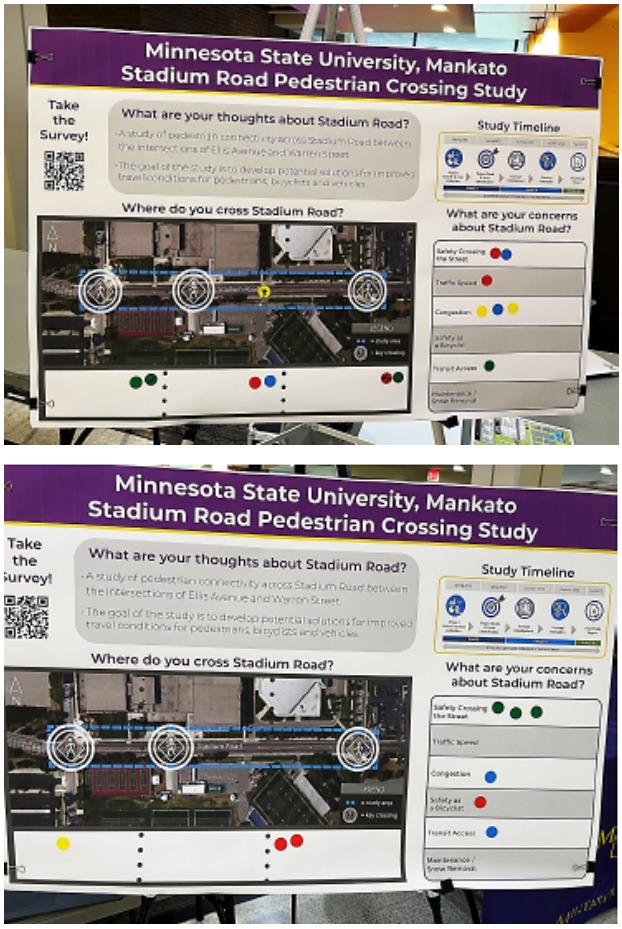
Of the 16 open-response comments received, key items included:

- Frequent close calls at Warren Street. Generally, it is perceived that people traveling by all modes do not obey the traffic signals.
- Sight distance issue ascending the hill along Stadium Road toward Ellis Avenue.
- Update existing crosswalk markings as vehicles stop in the crosswalk.
- The RRFB crossing generally works well.
- The perception that people traveling by any mode are distracted.

Pop-up Event

On April 20, 2022, the study team hosted a pop-up event at the Centennial Student Union with approximately 20 students, staff, and faculty engaged. Boards of the study area alongside information about the project were provided. The team engaged with many students, as well as staff (including campus transit staff). The following themes were brought up frequently:

- Concerns at Warren Street with people walking and biking not waiting their turn at the signal. The northbound left-turning movement becomes very delayed due to the volume of people using the crosswalk. Close calls between people walking and biking nearly being hit by turning vehicles.
- Most people do informal crossings mid-block, they know they'll have to wait if they go to either end of the intersection, notably between the RRFB and Warren Street.



Interactive boards used at the pop-up with corresponding results. Source: SRF Consulting Group, 2022

- Poor visibility ascending the hill through the Ellis Avenue intersection, not knowing if the light is green or not.
- Overall, there is a lot of distraction by all users of the transportation network here.

ISSUE IDENTIFICATION & NEED SUMMARY

Key elements from the corridor review and issue identification analysis are organized by location.

- **Warren Street:** Significant conflicts with turning vehicles and pedestrian/ bicycle crossing results in traffic congestion and safety issues.
- **Mid-block (RRFB) Crossing:** Flashing lights are missed by some drivers when activated causing safety concerns (i.e., rear ends).
- **Ellis Avenue:** No overarching safety issues beyond sight distance for approaching vehicles ascending the hill.
- **General:** Bicyclists conflict with heavy pedestrian volumes on the sidewalks and crosswalks, and concerns regarding sidewalk maintenance.

CHAPTER 3: ALTERNATIVE DEVELOPMENT AND EVALUATION

Alternatives were developed for at-grade and potential grade-separated crossings of Stadium Road (CSAH 60). This section details the alternatives developed and evaluation process. Input was gathered from campus stakeholders, agency staff, and elected officials throughout the process.

ALTERNATIVE DEVELOPMENT

The alternatives were considered and evaluated quantitatively and qualitatively. The evaluation process included:

1. Review of issues identified by community stakeholders and study partners.
2. Evaluation of all modes including pedestrian/bicycle safety and traffic operation.
3. Presentation of alternatives to the campus community, Minnesota State Mankato Planning Committee, Blue Earth County Commissioners, Mankato City Council, MAPO Technical Advisory Committee (TAC), and MAPO Policy Board for input on preference and priority.
4. Evaluation by the PMT of input collected and confirmation of a recommended alternative.

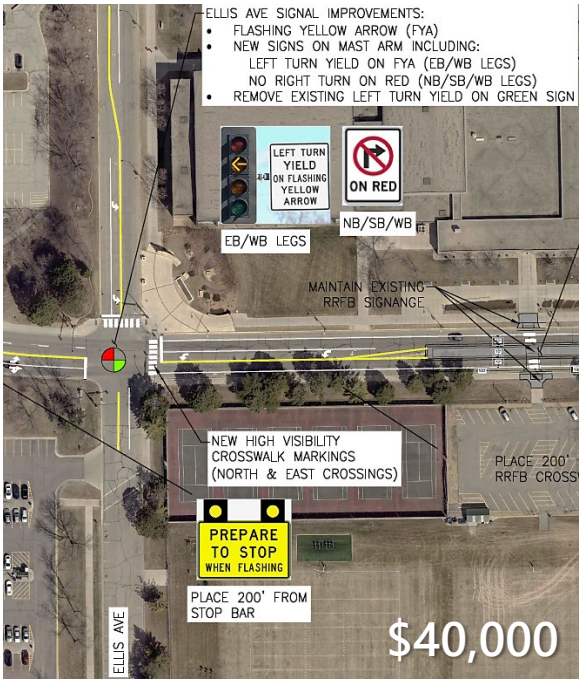
AT-GRADE CROSSINGS

Crossing improvements of the roadway at-grade were developed at Warren Street (three alternatives), the RRFB (one alternative), and Ellis Avenue (one alternative).

Ellis Avenue

One alternative was considered at Ellis Avenue which included:

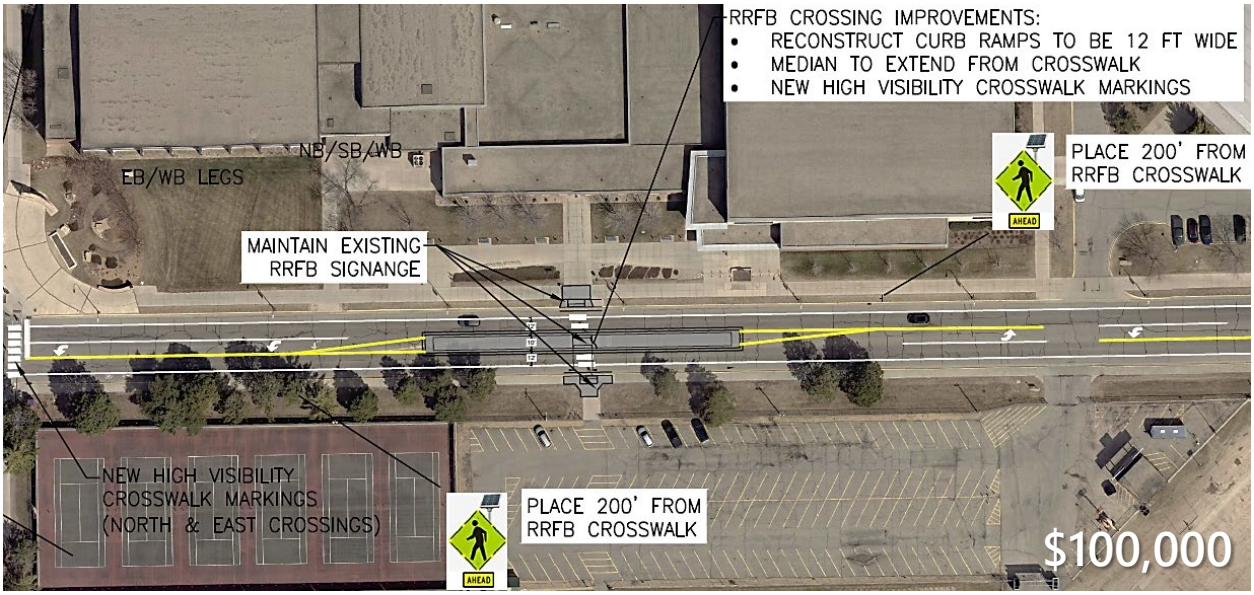
- Enhanced signage warning eastbound drivers of the traffic signal at Ellis.
- Signal update (Flashing Yellow Arrow)
- No Right-turn on Red signage
- Crosswalk marking and roadway striping refresh



RRFB Crossing

One alternative was considered at the existing RRFB crossing which included:

- Reconstruct the existing pedestrian refuge island (median) and lengthen it by 200 feet.
- Wider Americans with Disabilities Act (ADA)-compliant curb ramps due to crossing demand
- High visibility crosswalk markings
- Enhanced pedestrian warning signage (solar-powered LED, Wi-Fi connected to the RRFBs)



Warren Street

Three alternatives were studied at Warren Street to reduce the conflicts between turning vehicles and people walking, rolling, or bicycling in the crosswalk.

Alternative 1A

Alternative 1A proposes the following improvements:

- Leading Pedestrian Interval (LPI) and No Right-turn on Red (blank out sign)
- Crosswalk marking and roadway striping refresh

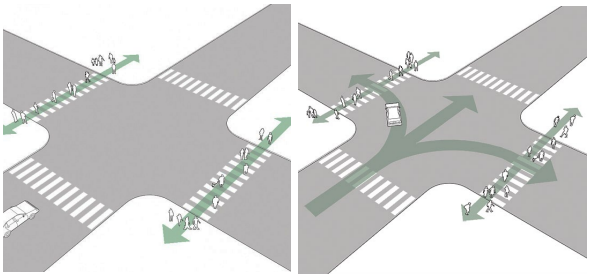


Illustration of an LPIs operation (left) and proposed improvements (right).

Opportunities

- Reduces conflicts between pedestrians and motorists.
- Enhances safety with less potential for crashes from turning vehicles.

Challenges

- Maintains existing design of Warren Street's northbound approach which is currently congested.

Alternative 1B

Alternative 1B proposes the following improvements:

- Leading Pedestrian Interval (LPI) and No Right-turn on Red (blank out sign)
- Crosswalk marking and roadway striping refresh
- Signal update (Flashing Yellow Arrow)
- Northbound left-turn lane

Opportunities

- Reduces conflicts between pedestrians and motorists.
- Improves the northbound Warren Street congestion.

Challenges

- Conflicts between pedestrians and turning vehicles will continue without exclusive phasing.

Alternative 2

Alternative 2 proposes the following improvements:

- Exclusive pedestrian phase (i.e., pedestrian scramble or Barnes Dance) and No Right Turn on Red (blank out sign)
- New ADA-compliant curb ramps (diagonal crossing)
- Crosswalk marking and roadway striping refresh
- Signal update (flashing yellow arrow)

Opportunities

- Significantly reduces conflicts between pedestrians and motorists.
- Enhances safety with limited potential for crashes from turning vehicles.

Challenges

- Maintains existing design of Warren Street's northbound approach which is congested.
- Could increase wait times for all modes.

Exclusive Pedestrian Phase

An exclusive pedestrian phase (also known as a pedestrian scramble or Barnes Dance) allows pedestrians and bikes to cross in all directions at one time during the cycle length, thus eliminating all conflicts with motorists (51 percent crash reduction).

MnDOT identifies locations where such signal phasing could be most effective and includes:

- Intersections with large concentrations of pedestrians (e.g., college campus, downtown)
- Intersections that experience high vehicular delay due to pedestrian crossing volumes.
- Intersections with high vehicle-pedestrian conflicts for most movements.

Exclusive pedestrian phases have been successfully implemented near college campuses across the United States, notably a regional example at Augustana University in Sioux Falls was implemented in 2018. It is located at West 33rd Street and South Grange Avenue, which is similar in design and traffic volumes to Stadium Road (CSAH 60) and Warren Street. The City of Minneapolis also implemented such a design in November 2022 at Richfield Road and W. Bde Maka Ska Parkway.

Traffic Impacts by Alternative

A traffic analysis was completed using PTV VISSIM to understand the potential impacts of each alternative (see Table 2). It was concluded that delay could increase, however the level of service (LOS) remains acceptable under all conditions for the overall intersection. All three alternatives do degrade traffic operations for Warren Street (see Appendix B). Alternative 2 produces the lowest impact to traffic congestion by intersection movement.

Table 2. Alternative Traffic Operations Analysis

Alternative	Midday		Δ Delay	Evening		Δ Delay
	Existing	Alternative		Existing	Alternative	
Alternative 1A	17 sec LOS B	28 sec LOS C	+11 sec	14 sec LOS B	21 sec LOS C	+7 sec
Alternative 1B	17 sec LOS B	24 sec LOS C	+7 sec	14 sec LOS B	20 sec LOS C	+6 sec
Alternative 2	17 sec LOS B	25 sec LOS C	+8 sec	14 sec LOS B	26 sec LOS C	+12 sec

Source: SRF Consulting Group, 2022

Pedestrian Impacts by Alternative

A pedestrian delay and travel time analysis was completed using PTV VISSIM to understand the potential impacts of each alternative (see Table 3 and Table 4). The travel time was organized only for those traveling the movement northwest to southeast or vice versa as this is the primary movement. The two directions were averaged for comparative purposes. The pedestrian delay is the average of all pedestrian crossing movements at the intersection (see Appendix B).

It was concluded that pedestrian travel time could increase under Alternative 1A and 1B and decrease with Alternative 2. Pedestrian delay increases slightly under all scenarios except in the evening under Alternative 1A and 1B. Of the three, Alternative 2 produces the lowest impact for pedestrians because though delay increases by ten seconds, the overall travel time savings produce the greatest benefit.

Table 3. Alternative Pedestrian Travel Time Analysis

Alternative	Midday		Δ Delay	Evening		Δ Delay
	Existing	Alternative		Existing	Alternative	
Alternative 1A	118 seconds	119 seconds	+1 sec	119 seconds	119 seconds	+0 sec
Alternative 1B	118 seconds	134 seconds	+16 sec	119 seconds	120 seconds	+1 sec
Alternative 2	118 seconds	101 seconds	-17 sec	119 seconds	104 seconds	-15 sec

Source: SRF Consulting Group, 2022

Table 4. Alternative Pedestrian Delay Analysis

Alternative	Midday		Δ Delay	Evening		Δ Delay
	Existing	Alternative		Existing	Alternative	
Alternative 1A	37 seconds	38 seconds	+1 sec	29 seconds	29 seconds	+0 sec
Alternative 1B	37 seconds	46 seconds	+9 sec	29 seconds	29 seconds	+0 sec
Alternative 2	37 seconds	47 seconds	+10 sec	29 seconds	39 seconds	+10 sec

Source: SRF Consulting Group, 2022

Alternative Evaluation

An evaluation was completed at each location to understand potential final recommendations. The feedback received throughout this process was critical toward updating the initially developed alternatives.

- **Ellis Avenue:** Remove the proposed No Right Turn on Red restriction.
- **RRFB Crossing:** Shorten the proposed median length to deter jaywalking.

Warren Street

A thorough quantitative and qualitative evaluation process was completed to determine which of the three alternatives is most appropriate for recommended implementation (Table 5). The following metrics were considered:

- **Pedestrian and Bicycle Safety:** Implement safety enhancements to reduce close calls/near misses and crashes.
- **Pedestrian and Bicycle Delay:** Limit overall delay waiting to cross to reduce risk taking behavior.
- **Traffic Operations:** Consider the impact on intersection traffic operations.
- **Pedestrian Operations:** Implement improvements that support existing pedestrian desire lines to access campus (i.e., the predominate southeast to northwest movement).
- **Estimated Cost:** Produce fiscally constrained projects.
- **Community Support:** Implement improvements supported by the university campus community, agency staff, and elected officials.

Table 5. Warren Street Alternative Evaluation Matrix

	Ped/Bike Safety	Ped/Bike Delay	Traffic Operations	Pedestrian Operations	Estimated Cost	Community Support
Alt 1A	–	✖	✖	–	✚	✖
Alt 1B	✚	✖	✖	–	–	–
Alt 2	✚	✖	✖	✚	✖	✚

✚ = *positive impact,* – = *neutral impact,* ✖ = *negative impact*

Source: SRF Consulting Group, 2022

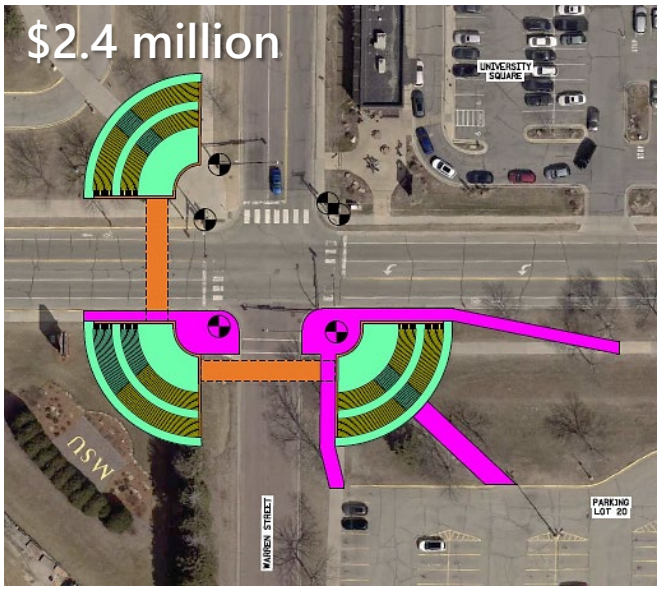
GRADE-SEPARATED CROSSINGS

Three alternatives were developed at Warren Street to separate pedestrians and bicyclists from vehicular traffic. Two alternatives would go under the roadway, and one is a bridge over.

Of note, the grade separated crossing analysis constituted a very high-level review of feasibility based upon utility as-builts shared by the City of Mankato and a Gopher State One Call completed in summer 2022. The analyses provided a high-level understanding of utility conditions within the area though further analysis and design are required. The images produced are conceptual in nature and meant to demonstrate a planning-level understanding of grade-separated options. Utility mitigation, impacts, and/or relocations was beyond the scope of this study and would require further review. Due to scope limits regarding survey and topographical review, ADA-compliant access was not included in the conceptual design but should be considered upon future design development. Any additional enhanced items such as larger tunnels, ADA-ramps, and landscaping are not included in the high-level cost estimate at this time and will rely upon further study to define those details.

Alternative A1

Alternative A1 proposes a three-quadrant underpass which would tunnel under the south intersection leg of Warren Street and west leg of Stadium Road (CSAH 60). The proposed undercrossing involves two typical sized precast concrete box culvert underpass structures. Open plaza areas are provided at the entrance to each underpass which can include different configurations for stairs, ADA compliant ramps and/or landscaping. Wide open plaza areas are preferrable to allow easy access into the crossing from various directions to maximize usage.



Opportunities

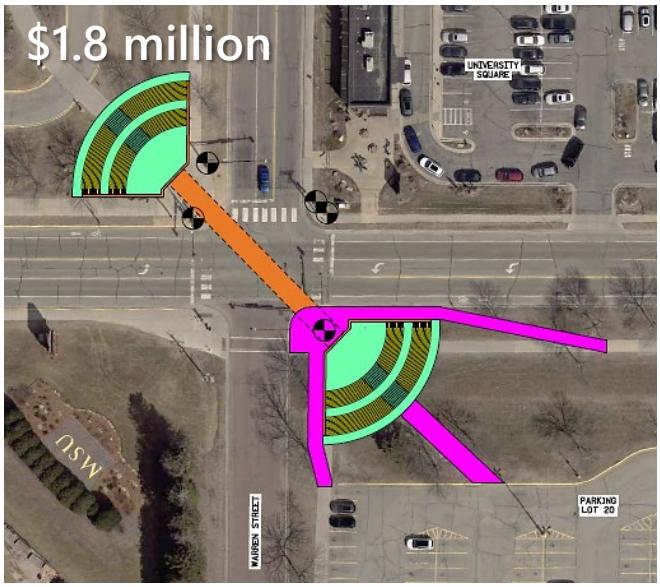
- Provides a grade separation for the primary movement.
- Open plaza areas introduce natural light into the tunnel and shorten box culvert segments.

Challenges

- Longer route to complete the primary movement as opposed to Alternative A2.
- Requires construction in three of four intersection quadrants.
- Could be impacted by underground utilities due to the need for excavation.

Alternative A2

Alternative A2 proposes a two-quadrant underpass which would tunnel diagonally under the intersection of Warren Street and Stadium Road (CSAH 60). The proposed undercrossing involves two typical sized precast concrete box culvert underpass structures. Open plaza areas are provided at the entrance which can include different configurations for stairs, ADA compliant ramps and/or landscaping. Wide open plaza areas are preferrable to allow easy access into the crossing from various directions to maximize usage.



Opportunities

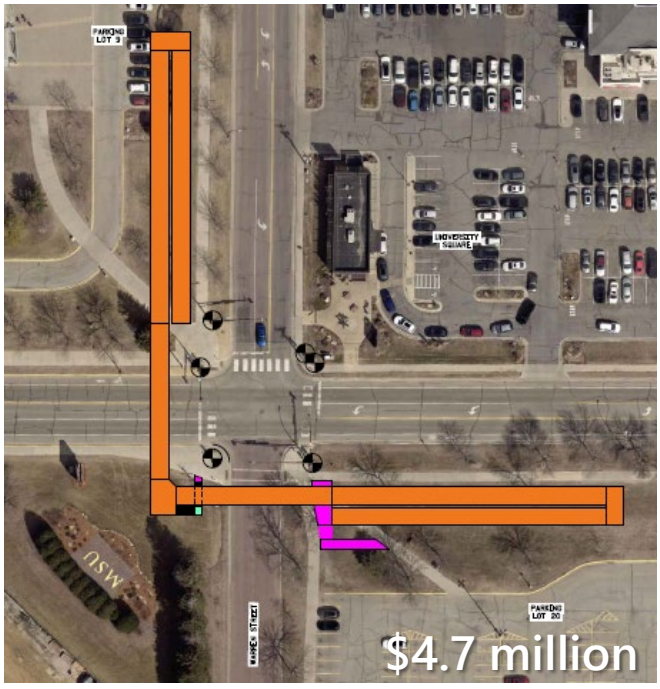
- Provides a direct grade separation for the primary movement.
- Open plaza areas introduce natural light into the tunnel and shortens box culvert segment.

Challenges

- Could be impacted by underground utilities due to the need for excavation.

Alternative B

Alternative B proposes a three-quadrant bridge over the intersection of Warren Street and Stadium Road (CSAH 60). The design includes long approach ramps, two prefabricated steel truss bridges over Stadium Road and Warren Street and a stair access to the bridge at the SW quadrant. Approach ramps are a combination of walk on fill supported by retaining walls and spans of concrete slabs, precast beams, or steel girders. Ramps can be made ADA compliant with grades up to 5 percent without landings so two 420-foot-long ramps are depicted at that grade.



The minimum bridge vertical clearance to the road below is 17.5 feet. However, special consideration of higher bridge clearance may be required to provide clear sight lines to the traffic signals when approaching the intersection from the west and south. A higher bridge would require longer ramps to remain ADA compliant.

Opportunities

- Provides grade separation for the primary movement.
- Fewer impacts to buried utilities.
- ADA-compliant access to the bridge in the NW and SE quadrants.

Challenges

- No ADA-compliant access in the SW quadrant.
- Provides the longest grade separated crossing so pedestrians may opt to continue crossing at-grade due to the indirect routing.
- Is the highest cost of the three alternatives.

Alternative Evaluation

An evaluation process was completed to determine which of the three alternatives is most appropriate for recommended implementation (Table 6). The following metrics were considered:

- **Pedestrian and Bicycle Delay:** Limit delay waiting to cross to reduce risk taking behavior.
- **Pedestrian Operations:** Implement improvements that support existing pedestrian desire lines to access campus (i.e., the predominate southeast to northwest movement).
- **Campus Aesthetics:** Consider the visual impact to this area of campus.
- **Right-of-way Impact:** Impact outside of the public right-of-way.
- **Estimated Cost:** Produce fiscally constrained projects.
- **Community Support:** Implement improvements supported by the university campus community, agency staff, and elected officials.

Table 6. Grade Separated Crossing Alternative Evaluation Matrix

	Ped/Bike Delay	Pedestrian Operations	Campus Aesthetics	ROW Impact	Estimated Cost	Community Support
Alt A1	✖	–	✚	–	✖	–
Alt A2	✚	✚	✚	–	✚	✚
Alt B	✖	✖	✖	✖	✖	✖

✚ = positive impact, – = neutral impact, ✖ = negative impact Source: SRF Consulting Group, 2022

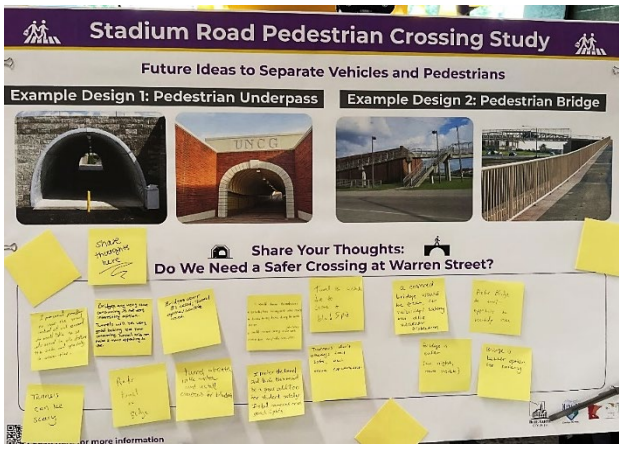
UNIVERSITY ENGAGEMENT – ROUND 2

To introduce the alternatives and gain input on locally supported options, the University campus community was engaged in September 2022 and involved several modes of online and in-person informational content and a pop-up event (see Appendix A).

Pop-up Event

On September 8, 2022, the study team hosted a pop-up event at the Centennial Student Union with approximately 40 students, staff, and faculty engaged. Boards of the at-grade crossing alternatives were displayed with an opportunity to vote on a preferred alternative for Warren Street, as well as share feedback on grade separated crossings. The following themes were brought up frequently:

- Strong support for the exclusive pedestrian phase at Warren Street.
- Desire for the addition of a northbound left-turn lane at Warren Street no matter the alternative.
- Safety improvements across Stadium Road (CSAH 60) will be beneficial for the campus community.
- Overarching support for grade separation with no clear leaning toward a tunnel or bridge; simply a desire to improve safety and access to campus.



Interactive boards used at the pop-up with corresponding results. Source: SRF Consulting Group, 2022

Minnesota State Mankato Planning Committee

A presentation to the Minnesota State Mankato Planning Committee was completed on August 31, 2022. The presentation included discussion of the planning process, existing conditions, engagement, alternative development and evaluation, project recommendation, and next steps (the same presentation was used through Round 2). Key questions involved how a tunnel would be constructed, potential cost sharing between agencies to implement such costly improvements, and how an exclusive pedestrian phase and/or no right-turn on red controls could impact traffic. Concerns were shared regarding how Alternative 1A did not improve safety over existing conditions and some support for the exclusive pedestrian phase with a northbound left-turn lane.

Blue Earth County Commissioners

A presentation to the Blue Earth County Commissioners was completed on September 20, 2022. Key questions involved the design of a tunnel, potential cost sharing between agencies to implement such costly improvements, and how an exclusive pedestrian phase and/or no right-turn on red controls could impact traffic. General support was shared by the commissioners for a grade separated crossing, notably Alternative A2, as well as support by one commissioner for the exclusive pedestrian phase.

Mankato City Council

A presentation to the Mankato City Council was completed on October 11, 2022. Key questions involved the design of a tunnel, potential cost sharing between agencies to implement such costly improvements, and how an exclusive pedestrian phase and/or no right-turn on red controls could impact traffic. A concern was shared by one councilmember regarding traffic congestion related to any turning controls at Warren Street. General support was shared by the councilmembers for a grade separated crossing, notably Alternative A2, as well as support by one councilmember for the exclusive pedestrian phase.

MAPO Technical Advisory Committee (TAC)

A presentation to the MAPO TAC was completed on October 20, 2022. Key questions involved the design of a tunnel, potential cost sharing between agencies to implement such costly improvements, and how an exclusive pedestrian phase and/or no right-turn on red controls could impact traffic. A discussion about RRFBs and their effectiveness was completed though general support for the at-grade improvements was confirmed.

MAPO Policy Board

A presentation to the MAPO Policy Board was completed on November 3, 2022. The Policy Board discussed the alternatives with and without a grade separated option. Overall, there was strong support for the grade separated crossing (Alternative A2) with pursuit of grant funding identified as key to implementation. Safety of a tunnel and optimal design widths were discussed but it was understood that the findings represent concepts only with more design needed to pursue actual construction.

The exclusive pedestrian phase ('the scramble' as noted by one policy board member) was heavily debated with historical reference to an attempt to implement that approach many years ago. Policy makers noted that the Augustana University crossings similarity provided a great example of what could work for an exclusive pedestrian phase. All agreed that they would prefer the tunnel option before considering the exclusive pedestrian phase.

CHAPTER 4: RECOMMENDATIONS

Based upon the alternative evaluation process and engagement with the university community, agency staff, and elected officials, final project recommendations were organized. If grant funding is secured, the preferred crossing is Alternative A2, the diagonal (SE/NW) underpass. Key elements for future evaluation of a underpass project include maximizing tunnel width and height as feasible, enhanced lighting and security call boxes, ADA-compliant ramp access, and high-quality finishes/landscaping. Of note, these go beyond the existing cost estimate identified by the study.

Based upon all the feedback received, a hybrid alternative for the three proposed at-grade crossing projects was created. A final conceptual design and cost estimate can be found in Appendix C. Of note, each cost is per project though efficiencies are possible if implemented as one broader project. At Warren Street, if the underpass is constructed then Alternative 1B is recommended for concurrent implementation. If the underpass is not constructed, then Alternative 2 is recommended for implementation. A demonstration project of the proposed signal changes (i.e., LPI) could be implemented to test the real-world impacts prior to construction.

Ellis Avenue ($35,000)

- Enhanced static signage warning eastbound drivers of the traffic signal.
- Crosswalk marking and roadway striping refresh (includes stop bars)

RRFB Crossing ($70,000)

- New 100-foot-long pedestrian refuge island (median).
- New 12-foot-wide ADA-compliant curb ramps.
- High visibility crosswalk markings
- Enhanced pedestrian warning signage (solar-powered LED, Wi-Fi connected to the RRFBs)

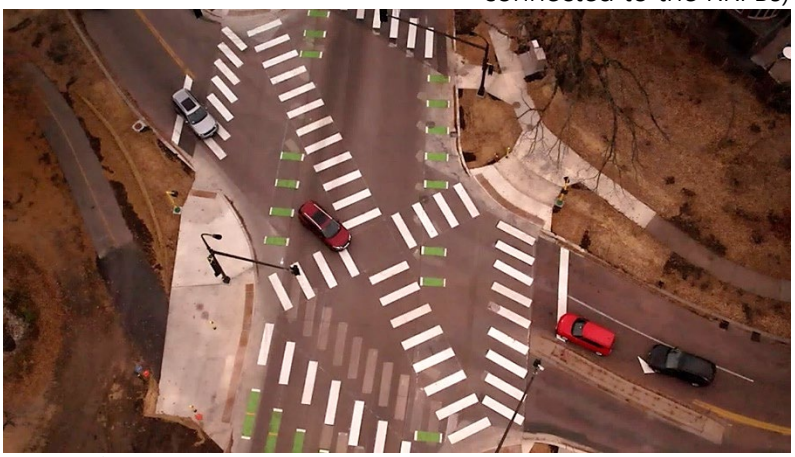
Warren Street

<u>If an underpass is implemented ($40,000):</u>

- LPI (7 sec), No Right Turn on Red (blank out sign)
- Crosswalk marking and roadway striping refresh (includes stop bars)
- Flashing Yellow Arrow
- Northbound left-turn lane

<u>If an underpass is not implemented ($90,000):</u>

- Exclusive pedestrian phase, No RTOR (blank out sign)
- New ADA-compliant curb camps (diagonal crossing)
- Flashing Yellow Arrow
- Crosswalk marking and roadway striping refresh (includes stop bars)
- Northbound left-turn lane



Example of a diagonal crossing installed in Minneapolis in November 2022.
Source: Fox 9 News

CHAPTER 5: IMPLEMENTATION PLAN AND NEXT STEPS

This document provides several recommendations for implementation within the study area. The proposed next steps are important as they will seek to maximize the Study's analysis by seeking grant funding, as well as design development for the recommended projects. Next steps include fully designing recommended at-grade improvements, as well as the grade-separated undercrossing if grant funding is secured. Continued close coordination between all partners (Blue Earth County, the City of Mankato, Minnesota State Mankato, and the MAPO) is critical to ensure the projects progress toward securing funding with the full buy-in of each agencies management and/or elected officials.

FUNDING STRATEGIES

The recommended projects identified by this study are not currently programmed and the implementation date is uncertain as of the completion of this study. Agency partners are encouraged to review funding solicitations as they arise to determine their applicability for implementing the grade separated crossing. The following are some strategies that could be considered for funding.

The most significant source of upcoming funds will be through the Infrastructure Investment and Jobs Act (IIJA) which will provide increased funds to a variety of existing federal formula programs, as well as funding for newly created funding programs. It is recommended that this be closely tracked as opportunities arise.

- Transportation Alternatives Program (TA): This is a federal funding source that is administered through MnDOT. The next solicitation for funds starting in 2027 for Greater Minnesota is planned underway as of the writing of this report. There technically is not an explicit maximum though the recommended cap per project is $1 million due to the limited available funding per Area Transportation Partnership (ATP). A 20 percent local match is required. This is the most promising grant opportunity so the next solicitation for 2028 funding should be closely tracked and coordinated with the ATP. Of note, ATP 7 has a funding allocation of $1.6 million for the 2022 solicitation.
- Highway Safety Improvement Program (HSIP): This is a federal funding source that is administered through MnDOT. The solicitation for funding years 2024-2027 is active in November 2022 and historically the program is on a two-year solicitation cycle. The maximum award amount is $750,000 per project and a 10 percent local match is required.
- Local Road Improvement Program (LRIP): State funding source administered by MnDOT. Funding is typically held annually, though due to the 2022 budget impasse at the legislature funding is not identified at the writing of this report. The maximum aware amount for the 2021 round was $1,250,000 per project and no match is required if all project costs are eligible.

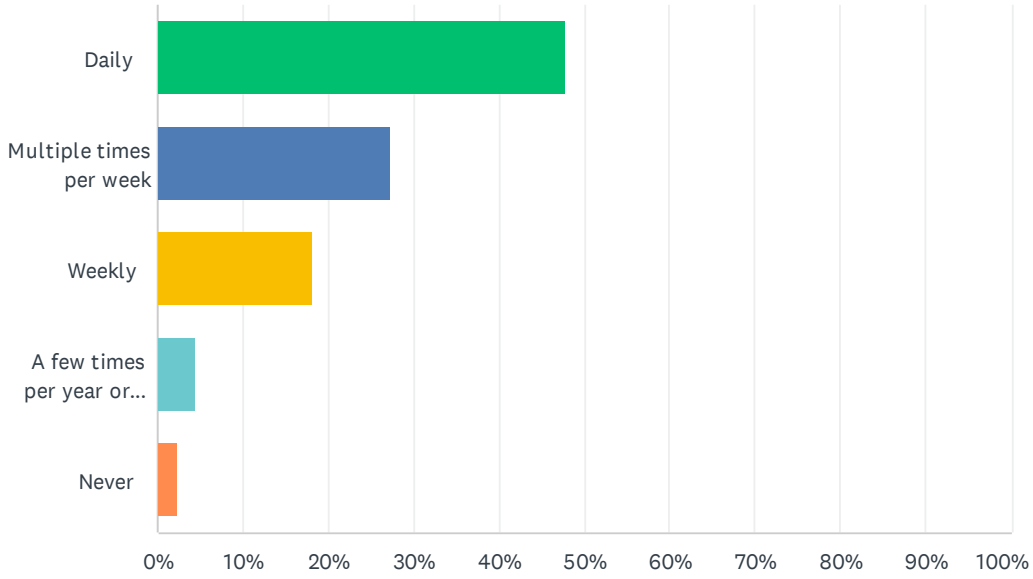
- State-Aid: Majority of the roadways within the study area are designed as Municipal State Aid Streets (MSASs) and are therefore eligible for State-Aid funding. State-Aid is a primary source of transportation funding in Minnesota. It is a reliable, predictable, and ongoing source of funds for many transportation needs. State-Aid can be used by cities for construction, improvement, or maintenance expenses and does not need to be paid back.
- Surface Transportation Block Grant Program: This is a federal funding source administered through MnDOT. This funding is flexible, and it is suggested to closely coordinate with the ATP to learn more.

A pedestrian crossing at the existing RRFB crossing. Source: SRF Consulting Group, 2022

APPENDIX A – COMMUNITY ENGAGEMENT RESULTS

Q1 How often do you travel along, or across, Stadium Road within the area shown on the map above?

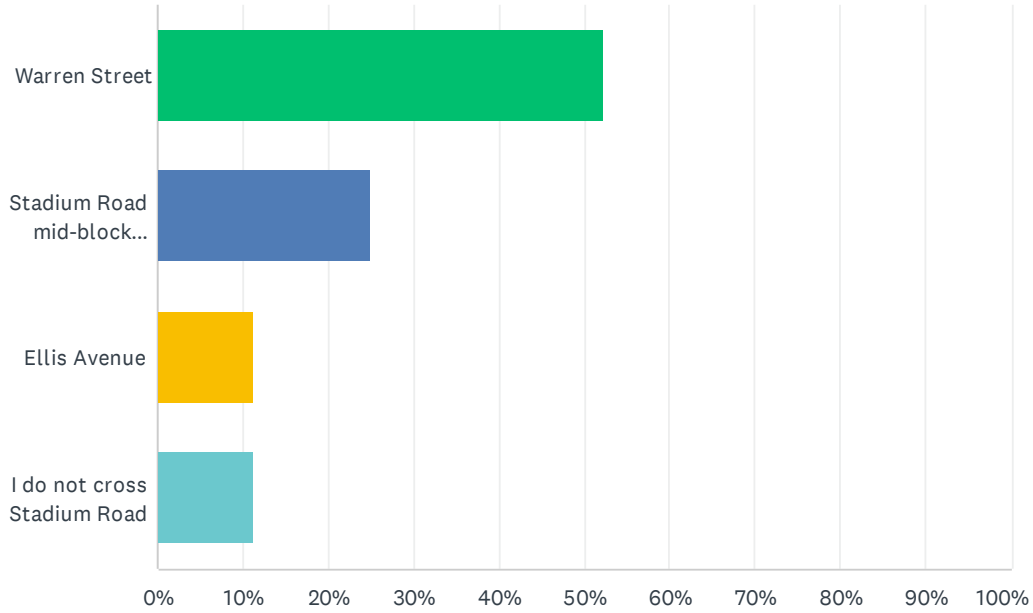
Answered: 44 Skipped: 0



ANSWER CHOICES	RESPONSES	
Daily	47.73%	21
Multiple times per week	27.27%	12
Weekly	18.18%	8
A few times per year or less	4.55%	2
Never	2.27%	1
TOTAL		44

Q2 Within the study area, I most often cross Stadium Road as a pedestrian or bicyclist at:

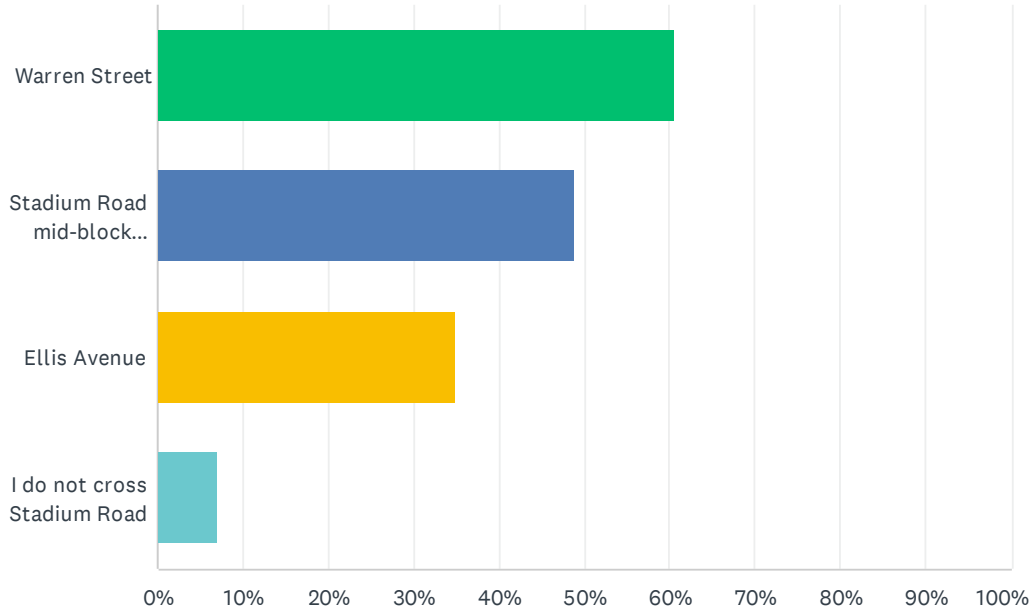
Answered: 44 Skipped: 0



ANSWER CHOICES	RESPONSES	
Warren Street	52.27%	23
Stadium Road mid-block crossing	25.00%	11
Ellis Avenue	11.36%	5
I do not cross Stadium Road	11.36%	5
TOTAL		44

Q3 Please select each of the crossing locations within the study area that you use as a pedestrian or bicyclist:

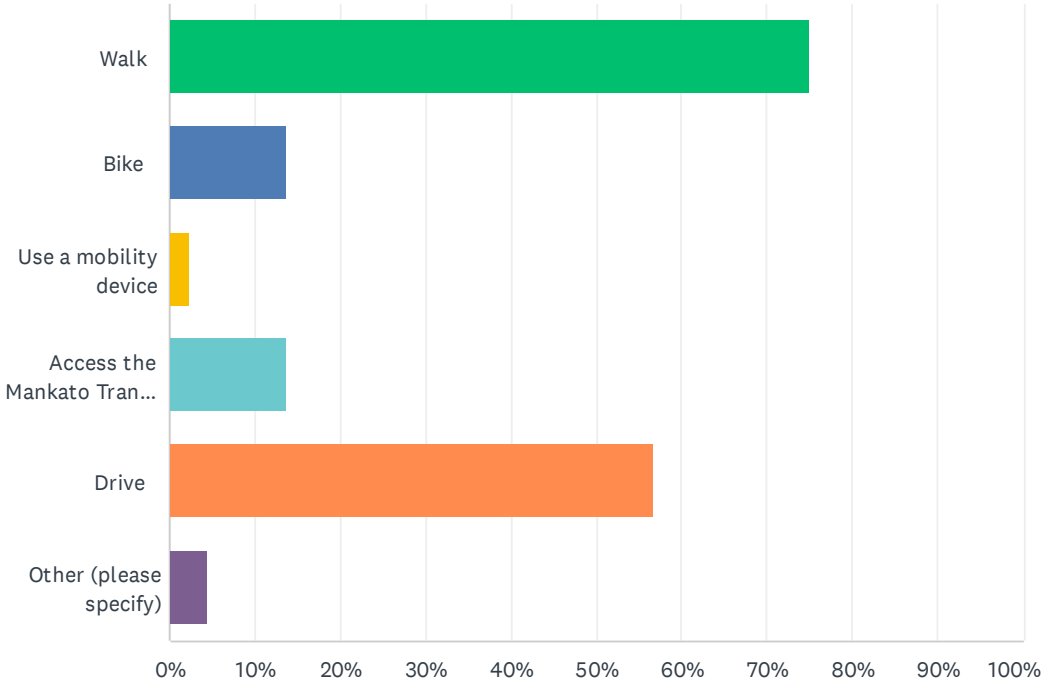
Answered: 43 Skipped: 1



ANSWER CHOICES	RESPONSES	
Warren Street	60.47%	26
Stadium Road mid-block crossing	48.84%	21
Ellis Avenue	34.88%	15
I do not cross Stadium Road	6.98%	3
Total Respondents: 43		

Q4 How do you use Stadium Road? (check all that apply)

Answered: 44 Skipped: 0

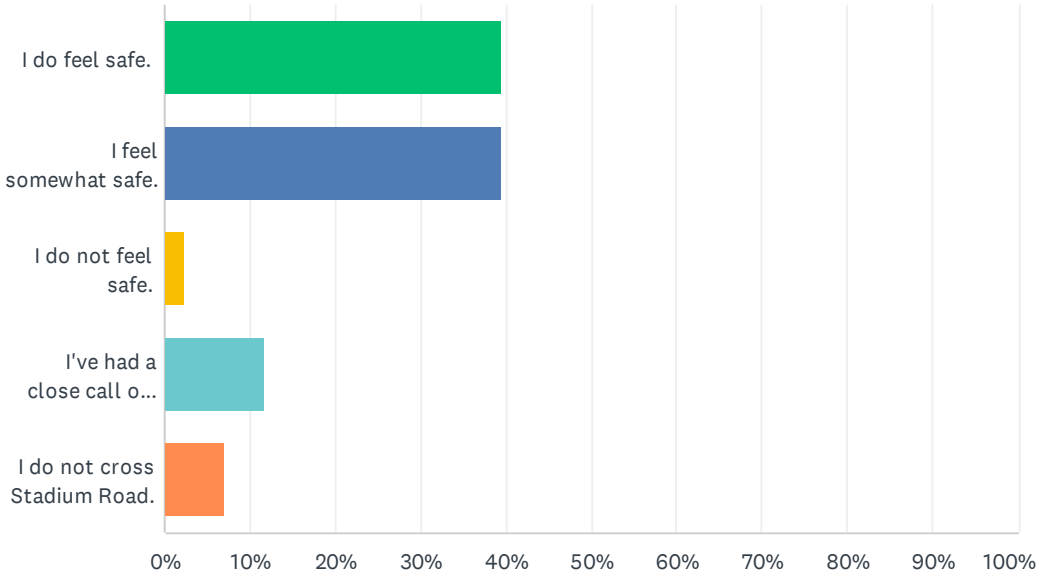


ANSWER CHOICES	RESPONSES	
Walk	75.00%	33
Bike	13.64%	6
Use a mobility device	2.27%	1
Access the Mankato Transit System	13.64%	6
Drive	56.82%	25
Other (please specify)	4.55%	2
Total Respondents: 44		

#	OTHER (PLEASE SPECIFY)	DATE
1	Electric Scooter	4/27/2022 2:38 PM
2	I don't know	4/20/2022 2:05 PM

Q5 How safe do you feel crossing Stadium Road while walking, rolling, or bicycling?

Answered: 43 Skipped: 1



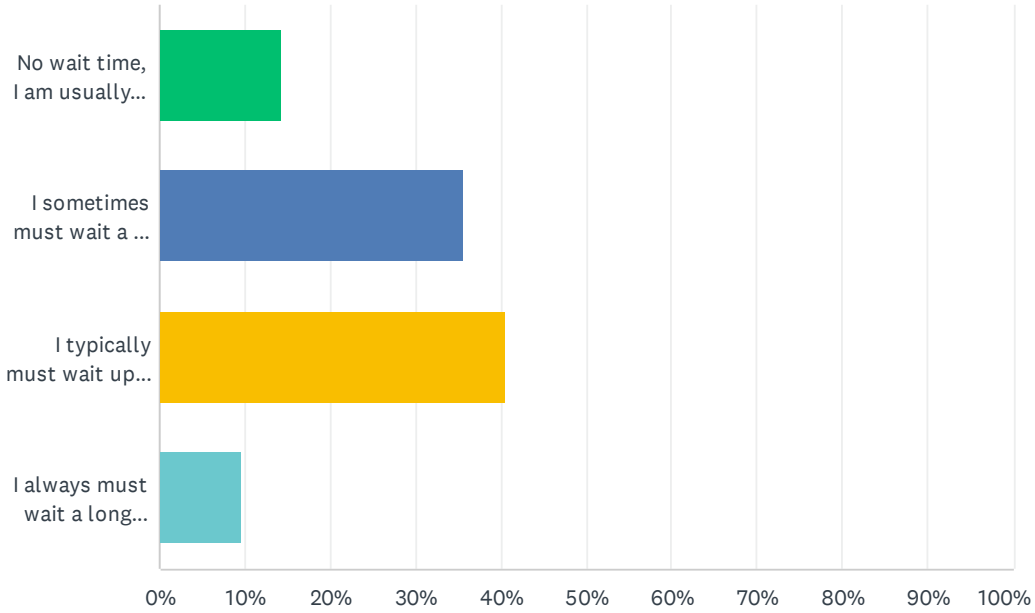
ANSWER CHOICES	RESPONSES	
I do feel safe.	39.53%	17
I feel somewhat safe.	39.53%	17
I do not feel safe.	2.33%	1
I've had a close call or have been hit.	11.63%	5
I do not cross Stadium Road.	6.98%	3
TOTAL		43

#	PLEASE SHARE ANY ADDITIONAL INFORMATION ABOUT YOUR EXPERIENCE CROSSING STADIUM ROAD:	DATE
1	Depends on traffic. Sometimes there are a lot of cars/traffic and sometimes (like weekends) it is pretty quite.	4/28/2022 11:23 AM
2	I've seen multiple people nearly be hit while I stood there waiting to cross.	4/28/2022 7:50 AM
3	I used to run. I utilized the Warren Street and Stadium cross area frequently. The time I had a close call was partly me not paying attention to a car turning. Fortunately a running buddy grabbed me and pulled me back!	4/27/2022 7:44 PM
4	At least once a semester, I have a close call. Usually from a car turning onto/off of Stadium Road at Warren Street.	4/27/2022 3:39 PM
5	Even though I drive, I don't feel safe with the student's crossing when they don't have a walk sign. The Stadium and Ellis intersection is horrible for this.	4/27/2022 3:24 PM
6	As long as myself and others follow the traffic rules and only cross at designated location and when permitted by the traffic lights, it is safe.	4/27/2022 3:17 PM

7	Many drivers do not pay attention at these intersections. Many times I have witnessed people texting while driving on Stadium Road, which does not help with safety for pedestrians or drivers.	4/27/2022 2:42 PM
8	The approach coming up the hill on Stadium to the Ellis crossing is difficult with the sun at times. It can be tricky to see the signals depending on the angle of the sun so having some sort of "warning" along the hill to know lights are red could be helpful as many come up that hill fast.	4/27/2022 2:39 PM
9	Traffic in this stretch of road doesn't get too fast, since it's between the hill and another intersection. The Stadium/Monks intersection is, by far, much worse.	4/27/2022 2:38 PM
10	Not so good	4/20/2022 2:52 PM
11	Stadium Road most of the time has to busy. When people crossing road have a risk	4/20/2022 2:05 PM
12	It’s convenient and easy way to reach university when u cross it with concentration.	4/20/2022 1:40 PM
13	I believe the intersection between the Lot7 and entrance to lot 8 can be made more safer by closing the middle lane, NO ISLAND though. Just block the middle lane with Paint and keep that space for the emergency vehicle to use in case of congestion on the road and the Emergency Vehicles need to move.	4/20/2022 1:35 PM
14	The center crossing point	4/20/2022 1:02 PM
15	The traffic is quite speedy and very loud, especially on the hill	4/20/2022 12:12 PM

Q6 When you cross Stadium Road while walking, rolling, bicycling, or driving, how long do you typically have to wait?

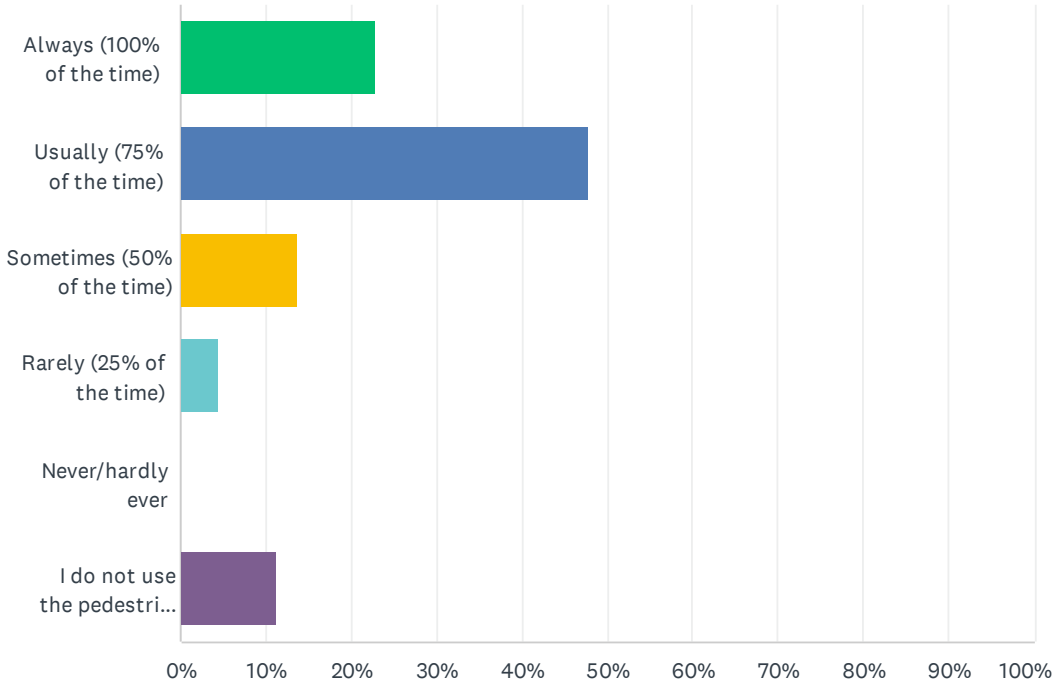
Answered: 42 Skipped: 2



ANSWER CHOICES	RESPONSES	
No wait time, I am usually able to cross when I would like to.	14.29%	6
I sometimes must wait a few seconds.	35.71%	15
I typically must wait up to a minute.	40.48%	17
I always must wait a long time (more than one minute).	9.52%	4
TOTAL		42

Q7 How often do vehicles stop for you when using the pedestrian crossing on Stadium Road?

Answered: 44 Skipped: 0



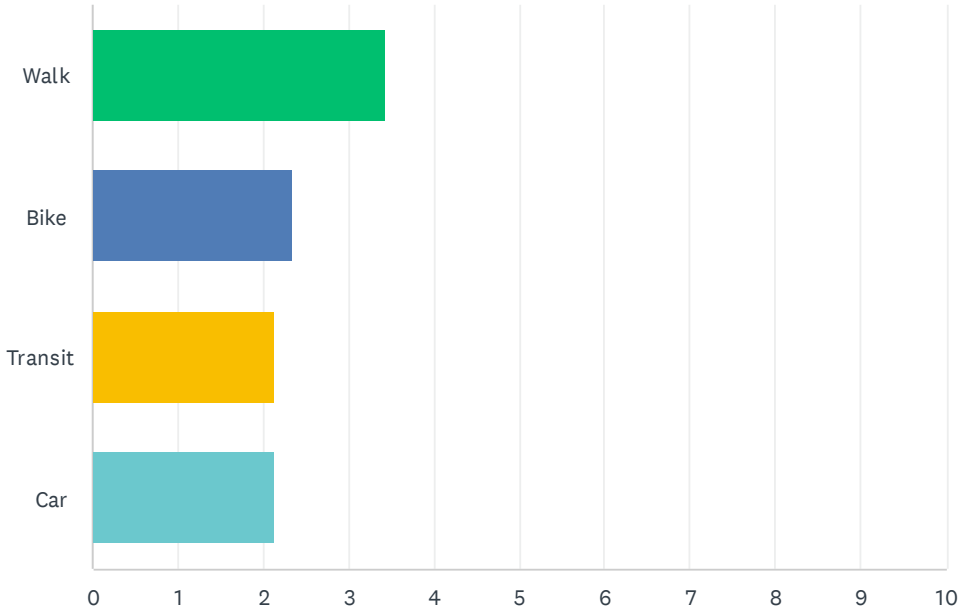
ANSWER CHOICES	RESPONSES	
Always (100% of the time)	22.73%	10
Usually (75% of the time)	47.73%	21
Sometimes (50% of the time)	13.64%	6
Rarely (25% of the time)	4.55%	2
Never/hardly ever	0.00%	0
I do not use the pedestrian crossing on Stadium Road.	11.36%	5
TOTAL		44

#	PLEASE SHARE ANY ADDITIONAL INFORMATION ABOUT THE MID-BLOCK CROSSING:	DATE
1	Noted that some pedestrians don't use the flashing lights when they should	4/28/2022 11:23 AM
2	I think this has really helped.	4/27/2022 3:24 PM
3	Turning the lights on, signals the drivers that I am needing to cross. Others that don't use the signal, I've seen some cars not stop.	4/27/2022 3:17 PM
4	Flashers do not seem to make people stop either.	4/27/2022 2:42 PM
5	Nothing	4/20/2022 2:05 PM
6	Be focused	4/20/2022 1:40 PM

7	I think the intersection that connects the lot 20 and the taylor center. Over there the Lines are less noticeable than the other 3 sides. Those lines need little more attention so the vehicles can notice them better and stop before the line. Now I see most people Stop at the line instead of before the line as its not much noticeable. Maybe a sign that says "STOP Here on RED" would be helpful	4/20/2022 1:35 PM

Q8 Please rank how you believe the transportation modes should be prioritized along Stadium Road?

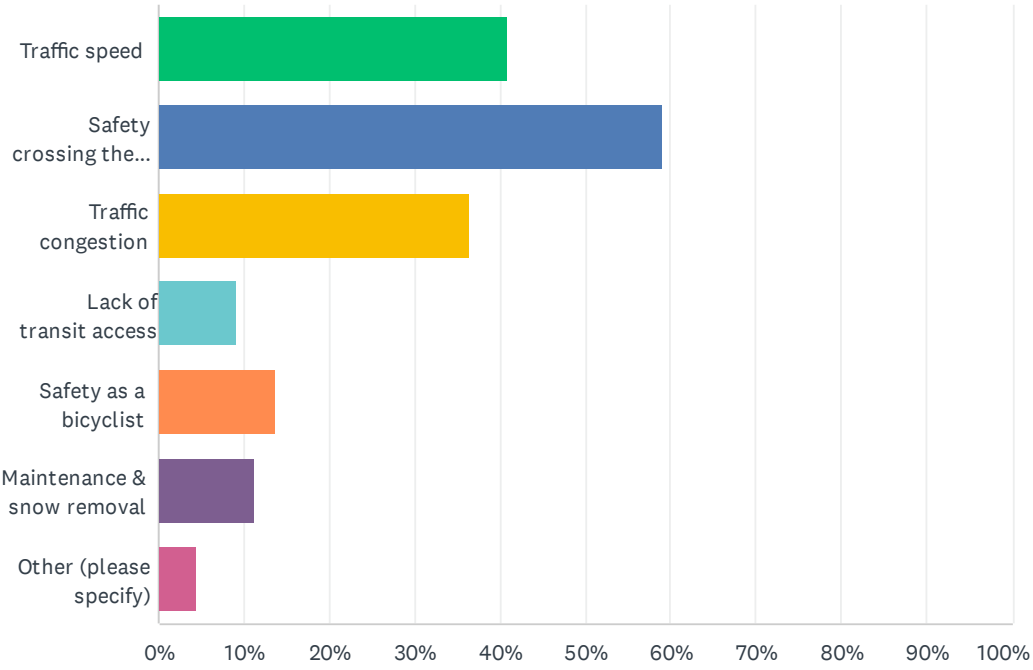
Answered: 43 Skipped: 1



	1	2	3	4	TOTAL	SCORE
Walk	68.29% 28	12.20% 5	14.63% 6	4.88% 2	41	3.44
Bike	7.50% 3	47.50% 19	17.50% 7	27.50% 11	40	2.35
Transit	10.00% 4	25.00% 10	32.50% 13	32.50% 13	40	2.13
Car	15.00% 6	17.50% 7	32.50% 13	35.00% 14	40	2.13

Q9 Please identify your top two concerns about Stadium Road (check the two that apply).

Answered: 44 Skipped: 0



ANSWER CHOICES	RESPONSES	
Traffic speed	40.91%	18
Safety crossing the street	59.09%	26
Traffic congestion	36.36%	16
Lack of transit access	9.09%	4
Safety as a bicyclist	13.64%	6
Maintenance & snow removal	11.36%	5
Other (please specify)	4.55%	2
Total Respondents: 44		

#	OTHER (PLEASE SPECIFY)	DATE
1	Students are great about using traffic signals. One area is by the football stadium. Many athletes just cross without paying attention to cars.	5/2/2022 9:06 AM
2	The campus (especially Stadium Rd) seems overly car-forward and pedestrians second (or third!). The entry into campus by foot is not welcoming and unsafe.	4/27/2022 10:38 PM

Q10 Do you have any additional comments or questions about the Stadium Road Pedestrian Crossing Study?

Answered: 16 Skipped: 28

#	RESPONSES	DATE
1	My main concern (though I no longer bike) is for cyclists. When going strait across on the right of cars. Cars turning right are looking left and don't notice bikes that have the right of way. This is stressful for bikers every time they have to cross and biking should be given priority as a mode of transportation to campus. I have had a couple of students get hit over the years in this situation and have seen others. I feel like it is fine how it is now for pedestrians, though some kind of all pedestrians cross in all directions simultaneously (including diagonally) might be an option.	5/2/2022 11:16 AM
2	I simply avoid that section of Stadium whether I am driving, walking or biking. I also find it frustrating that 90% of pedestrians do not take advantage of the traffic calming measures when crossing Warren St. Especially since it is as simple as pushing a button.	4/28/2022 4:51 PM
3	Crossing at Warren Street is terrible - it is a wonder more people aren't hit. No one - including myself - wants to wait that long in the cold/rain/wind/snow for the crosswalk light to turn. As a result, people are always darting across in breaks in traffic. And if there aren't breaks in traffic, it takes too long to cross. It is also is nearly impossible in a car to turn left from Warren onto Stadium (toward Stoltzman) if coming from the parking lots due to the pedestrian traffic crossing Stadium from campus. This is such a high traffic intersection that there should be a tunnel or bridge or something for pedestrians to safely cross without waiting and so cars don't have to wait for pedestrains too. When the weather is nice, I prefer to walk along Stadium to the mid-block crossing which feels safer and less stressful.	4/28/2022 7:50 AM
4	The campus (especially Stadium Rd) seems overly car-forward and pedestrians second (or third!). The entry into campus by foot is not welcoming and unsafe.	4/27/2022 10:38 PM
5	You can redesign the crossings, but without education and enforcement it will be in vain.	4/27/2022 7:44 PM
6	I see many people just cross the road not looking for cars, but rather looking at their phones. This happens at all highlighted areas of the study. When people stop and wait, use the signal indicator mid-block, cars stop and wait. This issue is people not waiting themselves before walking out. Even when pedestrians do not have the right away (at the traffic lights) they will walk out and then get upset at the cars. The traffic needs to be able to flow as well.	4/27/2022 3:17 PM
7	The sidewalk on both sides of the road is awful. Both sides are cracked and uneven with large potholes or tiles with more than an inch difference in height. I have to swerve around obstacles a lot.	4/27/2022 2:38 PM
8	No	4/25/2022 9:55 PM
9	No	4/25/2022 9:51 PM
10	Survey should be across Mankato Stakeholders to support the community in the best of everyone's interest.	4/21/2022 5:35 PM
11	No	4/20/2022 2:52 PM
12	I haven't idea	4/20/2022 2:05 PM
13	No	4/20/2022 2:02 PM
14	No	4/20/2022 1:40 PM
15	Its Good just need few extra paintings as suggested above and maybe a sign to make cars stop, where they need to rather than having them taking half of the Crosswalk when stopping	4/20/2022 1:35 PM
16	No	4/20/2022 11:13 AM

Q11 What is your Zip Code?

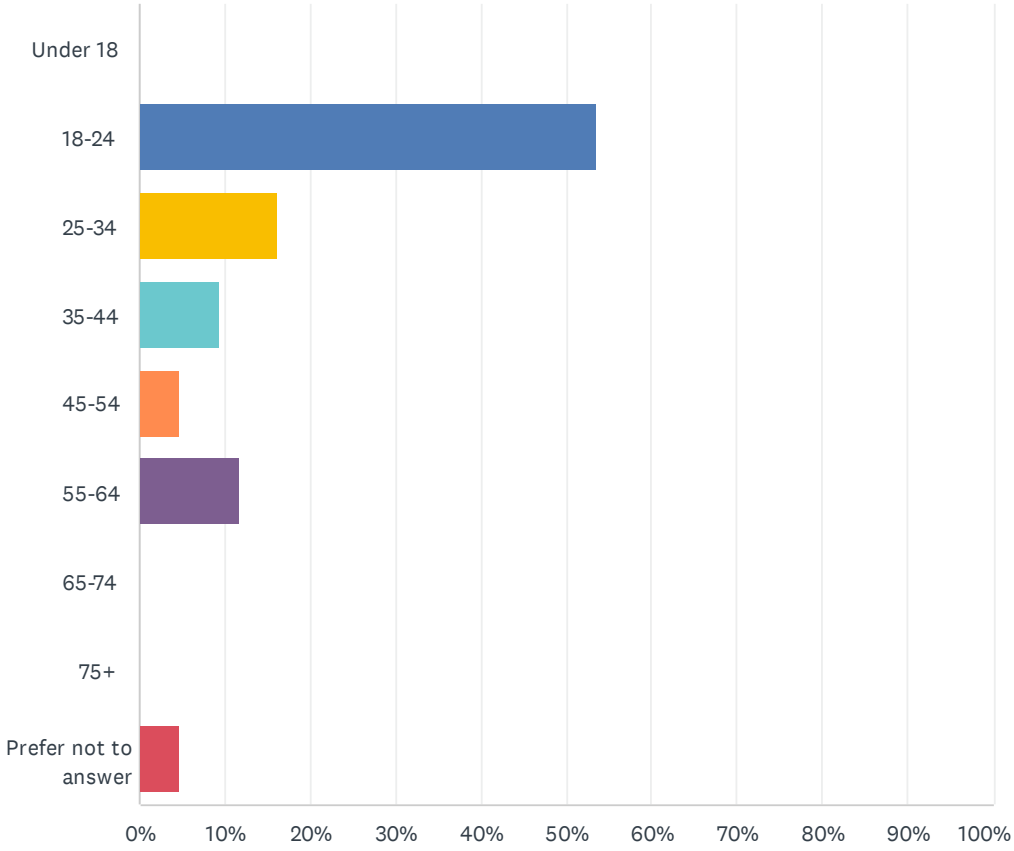
Answered: 41 Skipped: 3

#	RESPONSES	DATE
1	55369	5/5/2022 12:08 PM
2	56001	5/2/2022 11:17 AM
3	56001	5/2/2022 9:06 AM
4	56001	4/28/2022 4:52 PM
5	56001	4/28/2022 11:24 AM
6	56001	4/28/2022 7:51 AM
7	56001	4/28/2022 6:57 AM
8	56001	4/27/2022 10:38 PM
9	56001	4/27/2022 7:45 PM
10	56036	4/27/2022 3:47 PM
11	56001	4/27/2022 3:39 PM
12	56001	4/27/2022 3:18 PM
13	56001	4/27/2022 3:11 PM
14	56001	4/27/2022 2:53 PM
15	56001	4/27/2022 2:48 PM
16	56055	4/27/2022 2:43 PM
17	56001	4/27/2022 2:42 PM
18	56001	4/27/2022 2:39 PM
19	56001	4/27/2022 2:39 PM
20	56001	4/26/2022 9:26 AM
21	56001	4/25/2022 9:56 PM
22	56001	4/25/2022 9:52 PM
23	56001	4/25/2022 2:42 PM
24	56001	4/23/2022 3:04 PM
25	56001	4/22/2022 12:35 PM
26	56001	4/21/2022 7:30 PM
27	56001	4/21/2022 5:36 PM
28	56001	4/21/2022 5:31 PM
29	56001	4/21/2022 4:44 PM
30	56001	4/20/2022 2:55 PM
31	56001	4/20/2022 2:39 PM
32	56001	4/20/2022 2:37 PM
33	56001	4/20/2022 2:03 PM

34	56001	4/20/2022 1:46 PM
35	56001	4/20/2022 1:41 PM
36	56001	4/20/2022 1:35 PM
37	56001	4/20/2022 1:26 PM
38	56001	4/20/2022 1:02 PM
39	55744	4/20/2022 12:23 PM
40	55057	4/20/2022 12:13 PM
41	56001	4/20/2022 11:13 AM

Q12 What category contains your age?

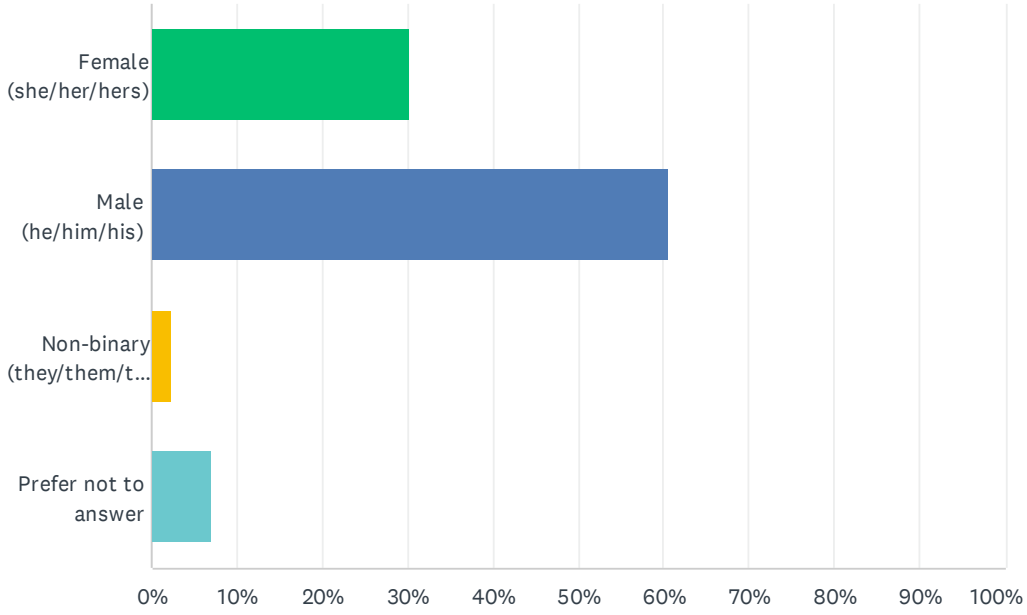
Answered: 43 Skipped: 1



ANSWER CHOICES	RESPONSES	
Under 18	0.00%	0
18-24	53.49%	23
25-34	16.28%	7
35-44	9.30%	4
45-54	4.65%	2
55-64	11.63%	5
65-74	0.00%	0
75+	0.00%	0
Prefer not to answer	4.65%	2
TOTAL		43

Q13 How do you self-identify in terms of gender?

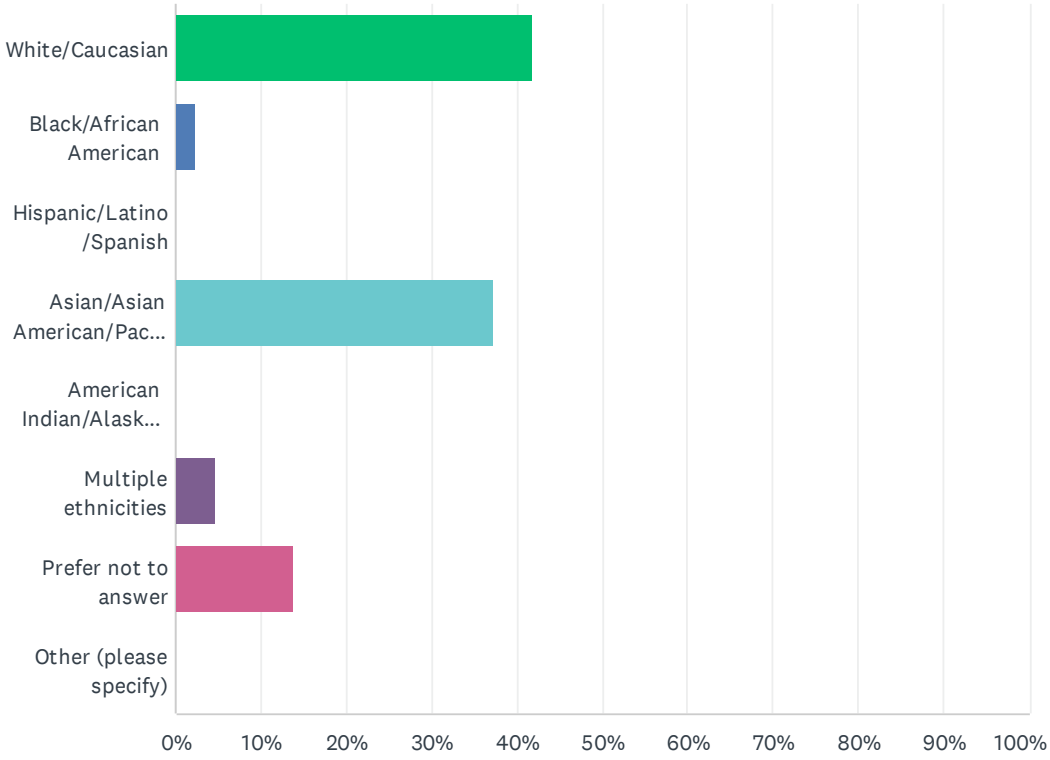
Answered: 43 Skipped: 1



ANSWER CHOICES	RESPONSES	
Female (she/her/hers)	30.23%	13
Male (he/him/his)	60.47%	26
Non-binary (they/them/theirs)	2.33%	1
Prefer not to answer	6.98%	3
TOTAL		43

Q14 What race/ethnicity best describes you?

Answered: 43 Skipped: 1



ANSWER CHOICES	RESPONSES	
White/Caucasian	41.86%	18
Black/African American	2.33%	1
Hispanic/Latino/Spanish	0.00%	0
Asian/Asian American/Pacific Islander	37.21%	16
American Indian/Alaskan Native	0.00%	0
Multiple ethnicities	4.65%	2
Prefer not to answer	13.95%	6
Other (please specify)	0.00%	0
TOTAL		43

#	OTHER (PLEASE SPECIFY)	DATE
	There are no responses.	

Q15 Please share your email if you would like to sign-up for occasional email updates about the Stadium Road Pedestrian Crossing Study:

Answered: 14 Skipped: 30

#	RESPONSES	DATE
1	paul.corcoran@mnsu.edu	4/28/2022 11:24 AM
2	sjcampa@gmail.com	4/28/2022 7:51 AM
3	alex.lucier@mnsu.edu	4/27/2022 2:39 PM
4	humaiyazaman.ema@mnsu.edu	4/25/2022 9:56 PM
5	asrafulalam.sefat@mnsu.edu	4/25/2022 9:52 PM
6	fariazaman.ela@mnsu.edu	4/25/2022 2:42 PM
7	Mdhamim.hossain@mnsu.edu	4/21/2022 7:30 PM
8	niamulhaque.akib@mnsu.edu	4/21/2022 5:31 PM
9	mdsharifulkhan0190@gmail.com	4/20/2022 2:55 PM
10	emonprince1603@gmail.com	4/20/2022 2:03 PM
11	apuchandra.bhowmik@mnsu.edu	4/20/2022 1:46 PM
12	sawaira.niaz@mnsu.edu	4/20/2022 1:41 PM
13	hdfocus1@gmail.com	4/20/2022 12:23 PM
14	festivefey@gmail.com	4/20/2022 12:13 PM

APPENDIX B –TRAFFIC AND PEDESTRIAN OPERATIONS EVALUATION

Intersection	Movement	Midday Peak Hour									PM Peak Hour								
		Target Volume	Existing		Alternative 1A		Alternative 1B		Alternative 2		Target Volume	Existing		Alternative 1A		Alternative 1B		Alternative 2	
			Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Stadium Rd & Ellis Ave	NBL	5	30.5	C	33.7	C	20.9	C	43.9	D	9	24.7	C	29.0	C	26.5	C	47.3	D
	NBT	10	25.2	C	28.5	C	30.4	C	46.7	D	14	21.1	C	24.8	C	35.0	D	48.3	D
	NBR	35	6.8	A	28.9	C	38.0	D	10.7	B	28	8.3	A	30.8	C	36.8	D	12.1	B
	SBL	113	31.8	C	36.1	D	26.6	C	49.3	D	92	35.9	D	39.9	D	24.9	C	51.3	D
	SBT	16	21.7	C	26.4	C	30.4	C	41.1	D	20	25.9	C	31.4	C	30.4	C	49.0	D
	SBR	40	5.7	A	25.2	C	26.8	C	11.2	B	49	7.5	A	29.5	C	29.3	C	14.7	B
	EBL	34	8.8	A	10.4	B	12.1	B	13.3	B	22	9.5	A	11.0	B	12.1	B	12.7	B
	EBT	213	9.2	A	13.7	B	15.8	B	16.8	B	300	10.0	A	14.3	B	16.5	B	18.2	B
	EBR	3	5.9	A	12.3	B	15.2	B	12.0	B	2	5.5	A	13.2	B	14.5	B	10.6	B
	WBL	33	7.6	A	9.8	A	11.6	B	10.7	B	35	9.1	A	11.1	B	8.6	A	15.0	B
	WBT	231	10.0	B	16.0	B	18.0	B	13.3	B	317	10.5	B	16.4	B	13.2	B	17.6	B
	WBR	120	7.8	A	15.8	B	20.2	C	9.8	A	85	9.0	A	16.1	B	12.4	B	16.9	B
	Overall		**12.4**	**B**	**18.9**	**B**	**20.0**	**B**	**19.2**	**B**	**Overall**	**12.9**	**B**	**19.2**	**B**	**17.2**	**B**	**21.7**	**C**

Intersection	Movement	Midday Peak Hour									PM Peak Hour								
		Target Volume	Existing		Alternative 1A		Alternative 1B		Alternative 2		Target Volume	Existing		Alternative 1A		Alternative 1B		Alternative 2	
			Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Stadium Rd & Warren St	NBL	33	81.5	F	117.2	F	25.2	C	50.5	D	30	38.0	D	46.5	D	24.3	C	52.2	D
	NBT	19	75.3	E	123.4	F	36.5	D	49.5	D	26	36.0	D	42.1	D	35.4	D	49.3	D
	NBR	10	66.2	E	109.2	F	30.8	C	24.4	C	16	15.5	B	38.3	D	38.5	D	26.6	C
	SBL	121	29.1	C	40.1	D	28.7	C	50.5	D	146	31.9	C	39.8	D	24.2	C	56.1	E
	SBT	18	24.9	C	52.8	D	54.7	D	36.6	D	15	24.9	C	34.0	C	32.1	C	48.5	D
	SBR	73	12.6	B	64.6	E	71.4	E	16.4	B	71	10.6	B	37.4	D	39.8	D	14.0	B
	EBL	42	11.1	B	12.3	B	14.2	B	20.6	C	58	9.3	A	11.6	B	12.2	B	17.8	B
	EBT	293	9.6	A	13.0	B	14.5	B	19.0	B	354	8.0	A	12.2	B	13.0	B	18.4	B
	EBR	26	13.8	B	16.5	B	19.2	B	16.2	B	8	8.3	A	13.0	B	13.1	B	15.7	B
	WBL	8	10.0	B	10.9	B	12.5	B	14.7	B	8	8.8	A	12.3	B	13.8	B	15.9	B
	WBT	278	12.0	B	16.5	B	19.7	B	20.8	C	336	10.6	B	15.5	B	19.5	B	21.6	C
	WBR	96	9.9	A	16.9	B	20.0	C	16.4	B	90	9.2	A	16.4	B	20.3	C	18.7	B
	Overall		**17.4**	**B**	**28.4**	**C**	**24.1**	**C**	**24.5**	**C**	**Overall**	**13.9**	**B**	**20.8**	**C**	**20.0**	**B**	**25.8**	**C**

Alternative 1A: LPI and No RTOR
Alternative 1B: LPI, No RTOR, NBL with FYA
Alternative 2: Ped Scramble with Diagonal Crosswalks

Cycle length increase from existing conditions implemented under all alternatives. Mid-day: 110 sec from 80 sec, PM: 120 sec from 84 sec

Movement	Midday Peak Hour											
	Volume	Existing		Alternative 1A		Alternative 1B		Alternative 2		**Change**		
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Opt 1	Opt 2	Opt 3
NBL	33	81.5	F	117.2	F	25.2	C	50.5	D	35.7	-56.3	-31
NBT	19	75.3	E	123.4	F	36.5	D	49.5	D	48.1	-38.8	-25.8
NBR	10	66.2	E	109.2	F	30.8	C	24.4	C	43	-35.4	-41.8
SBL	121	29.1	C	40.1	D	28.7	C	50.5	D	11	-0.4	21.4
SBT	18	24.9	C	52.8	D	54.7	D	36.6	D	27.9	29.8	11.7
SBR	73	12.6	B	64.6	E	71.4	E	16.4	B	52	58.8	3.8
EBL	42	11.1	B	12.3	B	14.2	B	20.6	C	1.2	3.1	9.5
EBT	293	9.6	A	13	B	14.5	B	19	B	3.4	4.9	9.4
EBR	26	13.8	B	16.5	B	19.2	B	16.2	B	2.7	5.4	2.4
WBL	8	10	B	10.9	B	12.5	B	14.7	B	0.9	2.5	4.7
WBT	278	12	B	16.5	B	19.7	B	20.8	C	4.5	7.7	8.8
WBR	96	9.9	A	16.9	B	20	C	16.4	B	7	10.1	6.5
Overall		17.4	B	28.4	C	24.1	C	24.5	C	11	6.7	7.1

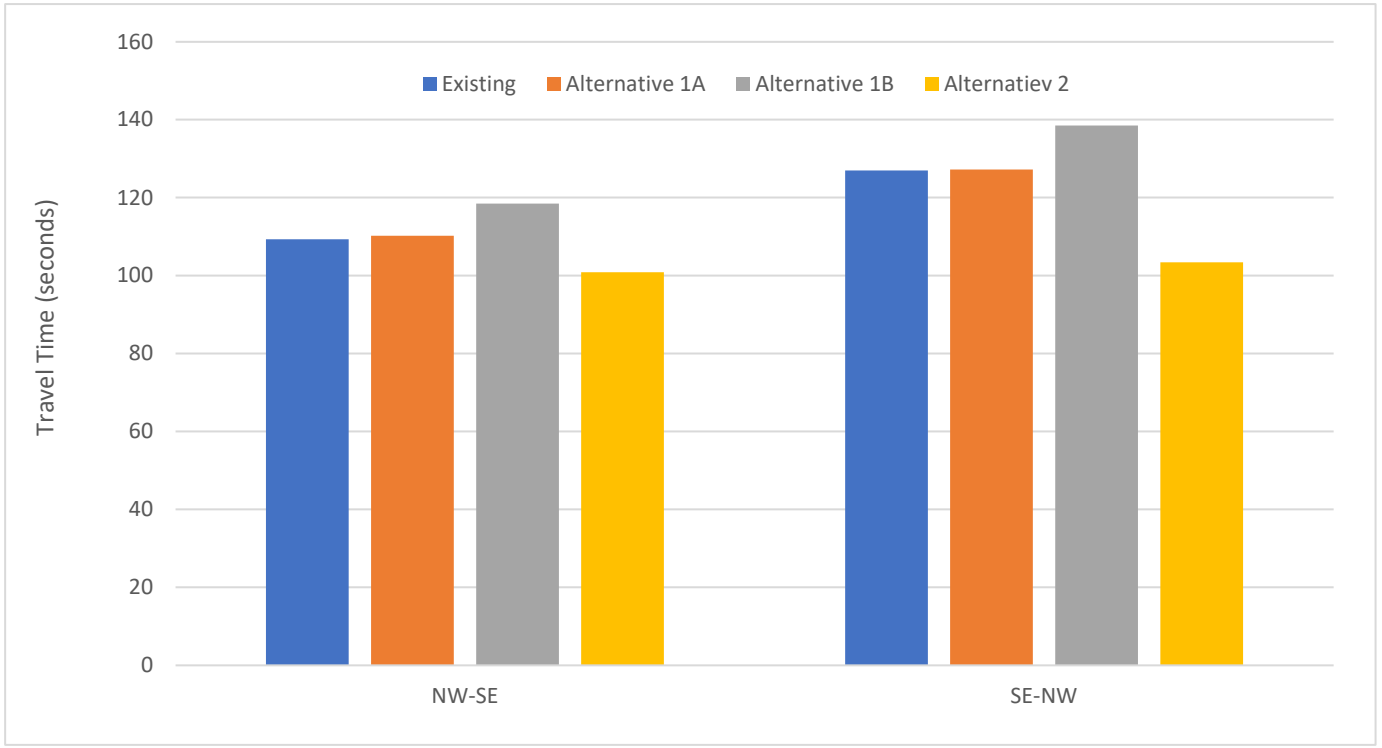
Option 1: LPI and No RTOR
Option 2: LPI, No RTOR, NBL with FYA
Option 3: Ped Scramble with Diagonal Crosswalks

Decrease in delay from existing.
Delay increase >10 seconds from existing.

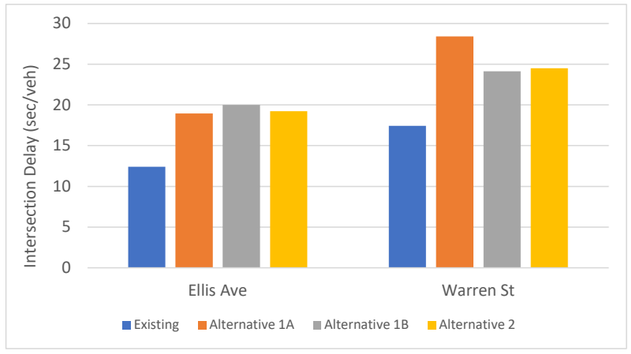
Movement	PM Peak Hour											
	Volume	Existing		Alternative 1A		Alternative 1B		Alternative 2		**Change**		
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Opt 1	Opt 2	Opt 3
NBL	30	38	D	46.5	D	24.3	C	52.2	D	8.5	-13.7	14.2
NBT	26	36	D	42.1	D	35.4	D	49.3	D	6.1	-0.6	13.3
NBR	16	15.5	B	38.3	D	38.5	D	26.6	C	22.8	23	11.1
SBL	146	31.9	C	39.8	D	24.2	C	56.1	E	7.9	-7.7	24.2
SBT	15	24.9	C	34	C	32.1	C	48.5	D	9.1	7.2	23.6
SBR	71	10.6	B	37.4	D	39.8	D	14	B	26.8	29.2	3.4
EBL	58	9.3	A	11.6	B	12.2	B	17.8	B	2.3	2.9	8.5
EBT	354	8	A	12.2	B	13	B	18.4	B	4.2	5	10.4
EBR	8	8.3	A	13	B	13.1	B	15.7	B	4.7	4.8	7.4
WBL	8	8.8	A	12.3	B	13.8	B	15.9	B	3.5	5	7.1
WBT	336	10.6	B	15.5	B	19.5	B	21.6	C	4.9	8.9	11
WBR	90	9.2	A	16.4	B	20.3	C	18.7	B	7.2	11.1	9.5
Overall		13.9	B	20.8	C	20	B	25.8	C	6.9	6.1	11.9

	Travel Times					
	NW - SE		SE - NW		Movement	
	MD	PM	MD	PM	NW-SE	SE-NW
Existing	110.14	107.9	124.91	130.36	109.3	127.0
Alternative 1A	110.97	108.97	126.57	128.22	110.2	127.2
Alternative 1B	123.16	110.71	144.22	129.01	118.5	138.5
Alternatiev 2	99.77	102.59	102.21	105.33	100.8	103.4

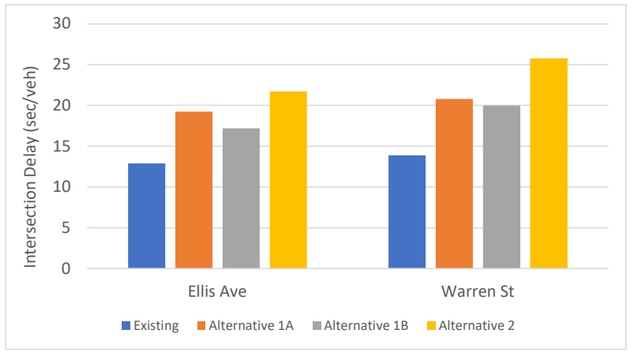
Warren	513	310		7.7%	18.6%



Scenario	*Midday Peak Hour*									*PM Peak Hour*								
	Pedestrian Metrics				Vehicle Metrics					Pedestrian Metrics				Vehicle Metrics				
	Pedestrians (ped/hr)	Travel Time (sec/ped)	Delay (sec/ped)	Flow Rate (ped/min/ft)	Vehicles (veh/hr)	Total Network Delay (hrs)	Intersection Delay (sec/veh)			Pedestrians (ped/hr)	Travel Time (sec/ped)	Delay (sec/ped)	Flow Rate (ped/min/ft)	Vehicles (veh/hr)	Total Delay (hrs)	Intersection Delay (sec/veh)		
							Stadium & Ellis	Stadium & Warren	Total							Stadium & Ellis	Stadium & Warren	Total
Existing	669	78.2	36.5	94.6	1,121	8.8	12.4	17.4	29.8	634	64.2	28.5	67.5	1,284	10.5	12.9	13.9	26.8
Alternative 1A	671	79.2	37.5	96.1	1,120	13.7	18.9	28.4	47.3	634	64.2	28.5	67.5	1,283	14.7	19.2	20.8	40.0
Alternative 1B	670	87.5	45.8	108.3	1,120	12.7	20.0	24.1	44.1	633	64.2	28.5	67.4	1,280	13.8	17.2	20.0	37.2
Alternative 2	669	85.1	47.2	60.7	1,117	12.7	19.2	24.5	43.7	634	72.0	38.6	53.5	1,280	17.2	21.7	25.8	47.5



Ellis Ave Warren St



Scenario	*Total Peak Hour*								
	Pedestrian Metrics				**Vehicle Metrics**				
	Pedestrians (ped/hr)	**Travel Time (sec/ped)**	**Delay (sec/ped)**	**Flow Rate (ped/min/ft)**	**Vehicles (veh/hr)**	**Total Network Delay (hrs)**	**Intersection Delay (sec/veh)**		
							Stadium & Ellis	**Stadium & Warren**	**Total**
Existing	1,303	142.4	65.0	162.1	2,405	19.2	25.3	31.3	56.6
Alternative 1A	1,305	143.4	66.0	163.6	2,403	28.4	38.2	49.2	87.3
Alternative 1B	1,303	151.8	74.3	175.7	2,400	26.5	37.2	44.1	81.3
Alternative 2	1,303	157.1	85.8	114.2	2,397	29.9	40.9	50.3	91.2

APPENDIX C – RECOMMENDED CONCEPT DESIGN AND COST ESTIMATE

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SRF

Job # 15210
10/28/2022 - 2:52PM

Alternative 3 Hybrid

MSU,M Stadium Road Pedestrian Crossing Study
Mankato, MN

Figure 4

MSU,M STADIUM ROAD PEDESTRIAN CROSSING STUDY
MANKATO, MN

ALTERNATIVE HYBRID

ELLIS AVE

Item	Unit	Price	Quantity	Cost
Signal Phasing Improvements	EA	$22,000	1	$22,000
Signing and Striping	LS	$3,000	1	$3,000
Traffic Control	LS	$1,000	1	$1,000
SUBTOTAL				$26,000
Mobilization (5%)				$1,300
Contingency (20%)				$5,200
ELLIS AVE TOTAL				**$33,000**

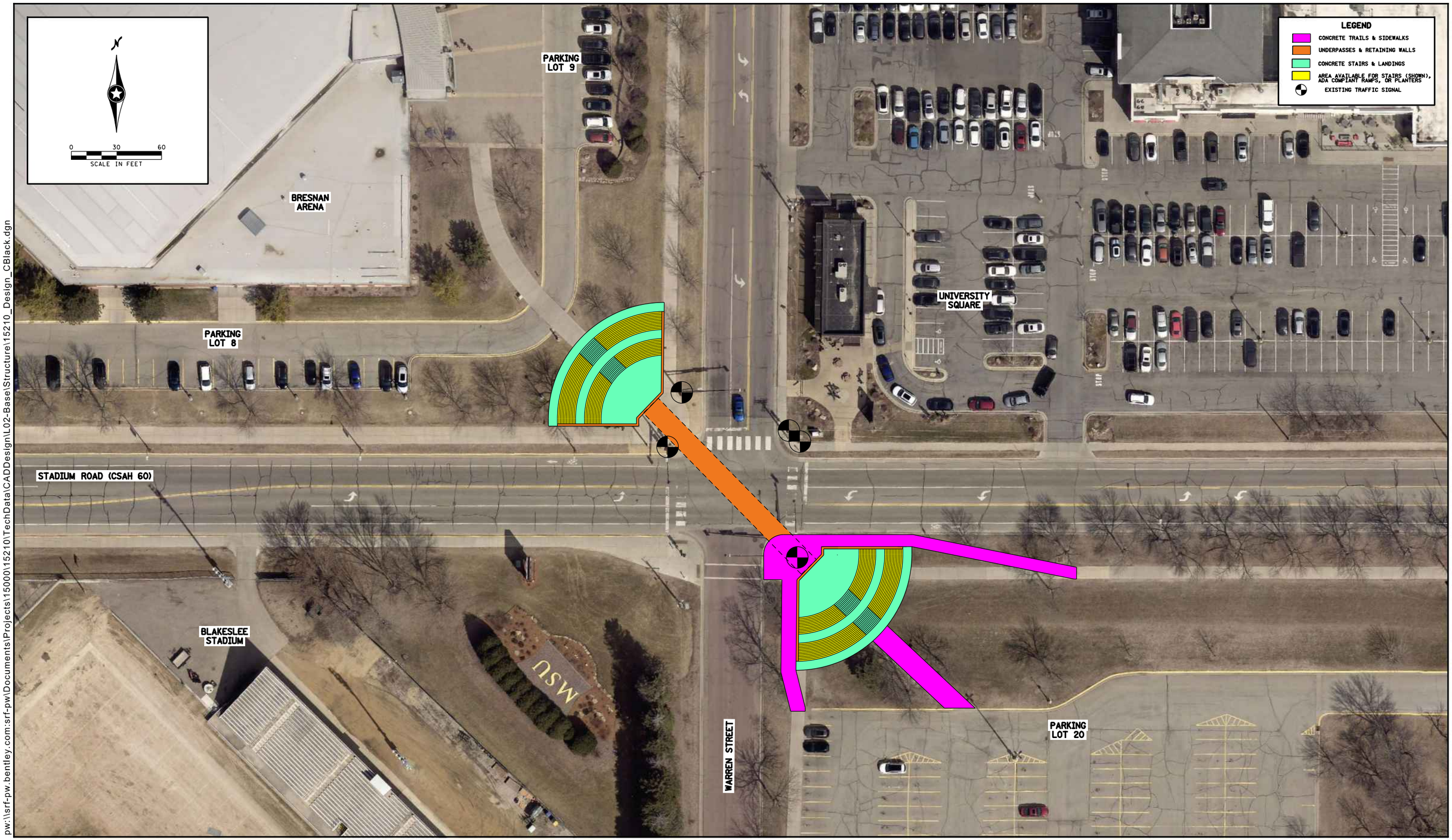
MID-BLOCK (STADIUM RD RRFB CROSSING)

Item	Unit	Price	Quantity	Cost
Remove Bituminous Pvmt	SF	$1.00	1,680	$1,680
Remove Concrete Walk	SF	$1.50	965	$1,448
Remove Concrete C&G	LF	$5.00	135	$675
Bituminous Pvmt (w/ Base)	SF	$5.00	670	$3,350
Concrete Walk & Ramps (w/ Base)	SF	$11.00	1,730	$19,030
Concrete B6 C&G (w/ Base)	LF	$25.00	290	$7,250
Truncated Domes	SF	$50.00	100	$5,000
Signing and Striping	LS	$3,000	1	$3,000
Traffic Control	LS	$3,000	1	$3,000
SUBTOTAL 1				$44,433
Grading (10%)				$4,400
Utility Relocation (10%)				$4,400
Turf and Erosion Control (3%)				$1,300
SUBTOTAL 2				$54,533
Mobilization (5%)				$2,700
Contingency (20%)				$10,900
MID-BLOCK TOTAL				**$68,000**

WARREN ST

Item	Unit	Price	Quantity	Cost
Remove Bituminous Pvmt	SF	$1.00	270	$270
Remove Concrete Walk	SF	$1.50	1,204	$1,806
Remove Concrete C&G	LF	$5.00	130	$650
Bituminous Pvmt (w/ Base)	SF	$5.00	270	$1,350
Concrete Walk & Ramps (w/ Base)	SF	$11.00	740	$8,140
Concrete B6 C&G (w/ Base)	LF	$25.00	130	$3,250
Truncated Domes	SF	$50.00	130	$6,500
Signal Phasing Improvements	EA	$25,000	1	$25,000
Signing and Striping	LS	$8,000	1	$8,000
Traffic Control	LS	$3,000	1	$3,000
SUBTOTAL 1				$57,966
Grading (10%)				$5,800
Utility Relocation (10%)				$5,800
Turf and Erosion Control (5%)				$2,900
SUBTOTAL 2				$72,466
Mobilization (5%)				$3,600
Contingency (20%)				$14,500
WARREN ST TOTAL				**$91,000**

TOTAL ESTIMATE	**$192,000**



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SRF

Job #15210
8/22/2022

Grade Separated Crossing Concepts - Alternative 1B, Two Quadrant Underpass

Mankato/North Mankato APO MSU Stadium Road Pedestrian Crossing Study

In the City of Mankato, Blue Earth County, Minnesota

Figure B1
2 of 3